



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

## **STANDARD LOW BID PROJECT**

October 27, 2006

# **12.5KV POWER UPGRADE ADMINISTRATION BUILDING AND FRED HOUSE ACADEMY**

## **DEPARTMENT OF CORRECTIONS DRAPER, UTAH**

DFCM Project Number 06139100

Intermountain Consumer Professional Engineers  
1145 East South Union Ave  
Salt Lake City, Utah 84121

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.

DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications & Drawings: ICPE, 1145 East South Union Ave, Salt Lake City, Utah

**The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>**

## NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

### **12.5 KV POWER UPGRADE**

### **ADMINISTRATION BUILDING AND FRED HOUSE ACADEMY**

### **DEPARTMENT OF CORRECTIONS – DRAPER, UTAH**

### **DFCM PROJECT NO: 06139100**

Bids will be in accordance with the Contract Documents that will be available at 4:00 PM on Friday, October 27, 2006 and distributed electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Jim Russell, DFCM, at 801-538-9784. No others are to be contacted regarding this bidding process. The construction budget for this project is \$160,000.00.

A **mandatory** pre-bid meeting will be held at 2:00 PM on Tuesday, October 31, 2006 at the Administration Building, Department of Corrections, 14717 Minuteman Drive, Draper, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Tuesday, November 14, 2006 at DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

Bid security, in the amount of five percent (5%) of the bid, must be submitted as stated in the Instruction to Bidders.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

Marla Workman, Contract Coordinator

4110 State Office Building, Salt Lake City, Utah 84114



## PROJECT SCHEDULE

| <b>PROJECT NAME:</b>   |            | <b>12.5 KV POWER UPGRADE<br/>ADMINISTRATION BUILDING AND FRED HOUSE ACADEMY<br/>DEPARTMENT OF CORRECTIONS – DRAPER, UTAH</b> |             |   |
|--|------------|--|-------------|---|
| <b>DFCM PROJECT NO.</b>  |            | <b>06139100</b>  |             |   |
| <b>Event</b>   | <b>Day</b> | <b>Date</b>  | <b>Time</b> | <b>Place</b>  |
| Bidding Documents Available  | Friday     | October 27, 2006   | 4:00 PM     | DFCM<br>4110 State Office Bldg<br>SLC, UT or DFCM web site *                                |
| <b>Mandatory</b> Pre-bid Site Meeting  | Tuesday    | October 31, 2006   | 2:00 PM     | Administration Building<br>Department of Corrections<br>14717 Minuteman Drive<br>Draper, UT |
| Last Day to Submit Questions   | Monday     | November 6, 2006   | 4:00 PM     | Jim Russell – DFCM<br>4110 State Office Bldg<br>SLC, UT                                     |
| Final Addendum Issued  | Wednesday  | November 8, 2006   | 4:00 PM     | DFCM web site *   |
| Prime Contractors Turn In Bid and Bid Bond / Bid Opening in DFCM Conference Room | Tuesday    | November 14, 2006  | 3:00 PM     | DFCM<br>4110 State Office Bldg<br>SLC, UT   |
| Sub-contractor List Due  | Wednesday  | November 15, 2006  | 3:00 PM     | DFCM<br>4110 State Office Bldg<br>SLC, UT   |
| <i>Project Completion</i>  | Monday     | April 16, 2007   |             |   |

\* DFCM's web site address is <http://dfcm.utah.gov>



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

## BID FORM

NAME OF BIDDER \_\_\_\_\_ DATE \_\_\_\_\_

To the Division of Facilities Construction and Management  
4110 State Office Building  
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **12.5 KV POWER UPGRADE – ADMINISTRATION BUILDING AND FRED HOUSE ACADEMY – DEPARTMENT OF CORRECTIONS – DRAPER, UTAH - DFCM PROJECT NO. 06139100** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: \_\_\_\_\_

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$\_\_\_\_\_) (In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially by **April 16, 2007**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$250.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of \_\_\_\_\_

The undersigned Contractor's License Number for Utah is \_\_\_\_\_

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

\_\_\_\_\_  
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

\_\_\_\_\_

Respectfully submitted,

\_\_\_\_\_  
Name of Bidder

ADDRESS:

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Authorized Signature

# INSTRUCTIONS TO BIDDERS

## 1. **Drawings and Specifications, Other Contract Documents**

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

## 2. **Bids**

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. NOTE: A cashier's check cannot be used as a substitute for a bid bond.

## 3. **Contract and Bond**

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

**4. Listing of Subcontractors**

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

**5. Interpretation of Drawings and Specifications**

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

**6. Addenda**

Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

**7. Award of Contract**

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.



**8. DFCM Contractor Performance Rating**

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

**9. Licensure**

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

**10. Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

**11. Time is of the Essence**

Time is of the essence in regard to all the requirements of the Contract Documents.

**12. Withdrawal of Bids**

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

**13. Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

**14. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

**15. Debarment**

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

## BID BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

### KNOW ALL PERSONS BY THESE PRESENTS:

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of \$ \_\_\_\_\_ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH** that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the \_\_\_\_\_ Project.

**NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH**, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

**DATED** this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**Principal's name and address (if other than a corporation):**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

**Principal's name and address (if a corporation):**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Affix Corporate Seal)

**Surety's name and address:**

\_\_\_\_\_  
\_\_\_\_\_

STATE OF \_\_\_\_\_ )  
COUNTY OF \_\_\_\_\_ ) ss.

By: \_\_\_\_\_  
Attorney-in-Fact (Affix Corporate Seal)

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My Commission Expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

Agency: \_\_\_\_\_  
Agent: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_

NOTARY PUBLIC

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

**Division of Facilities Construction and****INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

**PROJECTS UNDER \$500,000 - ALL SUBS \$20,000 OR OVER MUST BE LISTED**  
**PROJECTS \$500,000 OR MORE - ALL SUBS \$35,000 OR OVER MUST BE LISTED**

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

**LICENSURE:**

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

**BIDDER LISTING 'SELF' AS PERFORMING THE WORK:**

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

**'SPECIAL EXCEPTION':**

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

**INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**  
**Page No. 2**

**GROUND FOR DISQUALIFICATION:**

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

**CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:**

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

**EXAMPLE:**

Example of a list where there are only four subcontractors:

| TYPE OF WORK            | SUBCONTRACTOR,<br>"SELF" OR "SPECIAL EXCEPTION" | SUBCONTRACTOR<br>BID AMOUNT | CONT. LICENSE #                                      |
|-------------------------|---|-----------------------------|--|
| ELECTRICAL              | ABCD Electric Inc.                              | \$350,000.00                | 123456789000   |
| LANDSCAPING             | "Self"  | 300,000.00                  | 123456789000   |
| CONCRETE (ALTERNATE #1) | XYZ Concrete Inc                                | 298,000.00                  | 987654321000   |
| MECHANICAL              | "Special Exception"<br>(attach documentation)   | Fixed at: 350,000.00        | (TO BE PROVIDED<br>AFTER OBTAINING<br>SUBCONTRACTOR) |

**PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS  
SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.**

**SUBCONTRACTORS LIST**

FAX TO 801-538-3677

PROJECT TITLE: \_\_\_\_\_

Caution: You must read and comply fully with instructions.

| TYPE OF WORK | SUBCONTRACTOR,<br>"SELF" OR "SPECIAL EXCEPTION" | SUBCONTRACTOR<br>BID AMOUNT | CONT. LICENSE # |
|--------------|---|-----------------------------|-----------------|
|              |   |                             |                 |
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We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: \_\_\_\_\_

DATE: \_\_\_\_\_

SIGNED BY: \_\_\_\_\_

**NOTICE:** FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

# **FUGITIVE DUST PLAN**

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

**Utah Division of Air Quality**

*April 20, 1999*

**GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A  
DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7**

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.
2. Address or location of your operation or construction site.
3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.
4. Lengths of the project, if temporary (time period).
5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.
6. Type of material processed or disturbed.
7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).



8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.
9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).
10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

**Description of Fugitive Dust Emission Activities**  
**(Things to consider in addressing fugitive dust control strategies.)**

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).
2. List type of equipment generating the fugitive dust.
3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.
4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads “on” and “off” property.
5. Vehicle miles travels on unpaved roads associated with the activity (average speed).
6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)
7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

## **Description of Fugitive Dust Emission Controls on Site**

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.
2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).
3. Method of application of dust suppressant.
4. Frequency of application of dust suppressant.
5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).
6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

## **Description of Fugitive Dust Control Off-site**

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place “off” property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).
  
2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary  
Utah Air Quality Board  
POB 144820  
15 North 1950 West  
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000  
FAX: (801) 536-4099

## **Fugitive Dust Control Plan Violation Report**

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the source must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.
2. Time and duration of dust episode.
3. Meteorological conditions during the dust episode.
4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.
5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the source's dust control plan.
6. Reasons for failing to control dust from the dust generating activity or equipment.
7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.
8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

|                                 |                       |
|---------------------------------|-----------------------|
| Executive Secretary             | Phone: (801) 536-4000 |
| Utah Air Quality Board          | FAX: (801) 536-4099   |
| POB 144820                      |                       |
| 15 North 1950 West              |                       |
| Salt Lake City, Utah 84114-4820 |                       |

Attachments: DFCM Form FDR R-307-309, Rule 307-309

## CONTRACTOR'S AGREEMENT

FOR:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

THIS CONTRACTOR'S AGREEMENT, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and \_\_\_\_\_, incorporated in the State of \_\_\_\_\_ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is \_\_\_\_\_.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at \_\_\_\_\_.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

**ARTICLE 1. SCOPE OF WORK.** The Work to be performed shall be in accordance with the Contract Documents prepared by \_\_\_\_\_ and entitled "\_\_\_\_\_"

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

**ARTICLE 2. CONTRACT SUM.** The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of \_\_\_\_\_ DOLLARS AND NO CENTS (\$\_\_\_\_\_.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT  
PAGE NO. 2

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

**ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY.** The Work shall be Substantially Complete within \_\_\_\_\_ (\_\_\_\_) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of \$\_\_\_\_\_ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

**ARTICLE 4. CONTRACT DOCUMENTS.** The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

**ARTICLE 5. PAYMENT.** The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

CONTRACTOR'S AGREEMENT  
PAGE NO. 3

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

**ARTICLE 6. INDEBTEDNESS.** Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

**ARTICLE 7. ADDITIONAL WORK.** It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

**ARTICLE 8. INSPECTIONS.** The Work shall be inspected for acceptance in accordance with the General Conditions.

**ARTICLE 9. DISPUTES.** Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

**ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT.** This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.



**ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF.** The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

**ARTICLE 12. INDEMNIFICATION.** The Contractor shall comply with the indemnification provisions of the General Conditions.

**ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT.** The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

**ARTICLE 14. RELATIONSHIP OF THE PARTIES.** The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

**ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT.** Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

**ARTICLE 16. ATTORNEY FEES AND COSTS.** Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

CONTRACTOR'S AGREEMENT  
PAGE NO. 5

**IN WITNESS WHEREOF**, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

**CONTRACTOR:** \_\_\_\_\_

\_\_\_\_\_  
Signature Date

Title: \_\_\_\_\_

State of \_\_\_\_\_ )  
County of \_\_\_\_\_ )

\_\_\_\_\_  
Please type/print name clearly

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me, \_\_\_\_\_, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the \_\_\_\_\_ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

(SEAL)

\_\_\_\_\_  
**Notary Public**

My Commission Expires \_\_\_\_\_

APPROVED AS TO AVAILABILITY  
OF FUNDS:

\_\_\_\_\_  
David D. Williams, Jr. Date  
DFCM Administrative Services Director

**DIVISION OF FACILITIES  
CONSTRUCTION AND MANAGEMENT**

\_\_\_\_\_  
- Manager Date  
Capital Development/Improvements

APPROVED AS TO FORM:  
ATTORNEY GENERAL  
May 25, 2005  
By: Alan S. Bachman  
Asst Attorney General

APPROVED FOR EXPENDITURE:  
\_\_\_\_\_  
Division of Finance Date

**PERFORMANCE BOND**  
(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That \_\_\_\_\_ hereinafter referred to as the "Principal" and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_, for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which Contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**WITNESS OR ATTESTATION:**

**PRINCIPAL:**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

(Seal)

Title: \_\_\_\_\_

**WITNESS OR ATTESTATION:**

**SURETY:**

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

Attorney-in-Fact (Seal)

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

\_\_\_\_\_  
NOTARY PUBLIC

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

# PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

## KNOW ALL PERSONS BY THESE PRESENTS:

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of \_\_\_\_\_, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_ for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

## WITNESS OR ATTESTATION:

\_\_\_\_\_

## PRINCIPAL:

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)

Title: \_\_\_\_\_

## WITNESS OR ATTESTATION:

\_\_\_\_\_

## SURETY:

\_\_\_\_\_

By: \_\_\_\_\_ Attorney-in-Fact (Seal)

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

NOTARY PUBLIC

Agency: \_\_\_\_\_  
Agent: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General



## Division of Facilities Construction and Management

## CHANGE ORDER # \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

AGENCY OR INSTITUTION: \_\_\_\_\_

PROJECT NAME: \_\_\_\_\_

PROJECT NUMBER: \_\_\_\_\_

CONTRACT NUMBER: \_\_\_\_\_

ARCHITECT: \_\_\_\_\_

DATE: \_\_\_\_\_

| CONSTRUCTION<br>CHANGE<br>DIRECTIVE NO. | PROPOSAL<br>REQUEST<br>NO. | AMOUNT   |          | DAYS     |          |
|---|----------------------------|----------|----------|----------|----------|
|   |                            | INCREASE | DECREASE | INCREASE | DECREASE |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |
|   |                            |          |          |          |          |

|                              | Amount | Days | Date |
|------------------------------|--------|------|------|
| ORIGINAL CONTRACT            |        |      |      |
| TOTAL PREVIOUS CHANGE ORDERS |        |      |      |
| TOTAL THIS CHANGE ORDER      |        |      |      |
| ADJUSTED CONTRACT            |        |      |      |

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor: \_\_\_\_\_

Date

Architect/Engineer: \_\_\_\_\_

Date

Agency or Institution: \_\_\_\_\_

Date

DFCM: \_\_\_\_\_

Date

Funding Verification: \_\_\_\_\_

Date

Page \_\_\_\_ of \_\_\_\_ page(s)

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**CERTIFICATE OF SUBSTANTIAL COMPLETION**PROJECT \_\_\_\_\_ PROJECT NO: \_\_\_\_\_  
AGENCY/INSTITUTION \_\_\_\_\_

AREA ACCEPTED \_\_\_\_\_

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at \_\_\_\_\_ (time) on \_\_\_\_\_ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

\_\_\_\_\_

\_\_\_\_\_

The Owner acknowledges receipt of the following closeout and transition materials:

☐ As-built Drawings    ☐ O & M Manuals    ☐ Warranty Documents    ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of \_\_\_\_\_ (Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within \_\_\_\_\_ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$ \_\_\_\_\_. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

\_\_\_\_\_ by: \_\_\_\_\_  
CONTRACTOR (include name of firm) (Signature) DATE

\_\_\_\_\_ by: \_\_\_\_\_  
A/E (include name of firm) (Signature) DATE

\_\_\_\_\_ by: \_\_\_\_\_  
USING INSTITUTION OR AGENCY (Signature) DATE

\_\_\_\_\_ by: \_\_\_\_\_  
DFCM (Owner) (Signature) DATE

State of Utah  
Department of Administrative Services  
Division of Facilities Construction & Management  
4110 State Office Building  
Salt Lake City, Utah 84114

# Technical Specifications

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Department of Corrections  
Draper Prison Administration/Academy  
Underground Power Upgrade  
DFCM Project No. 06139100/

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APPROVALS:

\_\_\_\_\_  
Prime Agency

\_\_\_\_\_  
Date

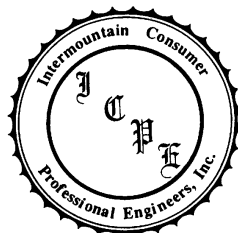
\_\_\_\_\_  
DFCM

\_\_\_\_\_  
Date

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APPROVAL DOES NOT RELIEVE A/E OF DESIGN LIABILITY

**OCTOBER 2006**



**Intermountain Consumer  
Professional Engineers, Inc.  
1145 East South Union Avenue  
Midvale, Utah 84047  
(801) 255-1111**





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**SUPPLEMENTAL GENERAL CONDITIONS**  
**PROJECT DESCRIPTION AND CONSTRUCTION REQUIREMENTS**  
**DISTRIBUTION LINE UPGRADE PROJECT**

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1. This project is titled, Draper Prison Admin/Academy Underground Power Upgrade, DFCM Project No. 06139100/Contract No. 067494. The distribution line construction site is located at the Utah State Prison, in Draper, Utah.
2. PROJECT DESCRIPTION
  - a. This project will require converting an existing, overhead, 12 kV overhead line to an underground 12 kV circuit. The circuit begins at the Utah State Prison, on the west side of I-15, at pole #9 and extends to the Department of Correction administrative buildings on the east side of I-15.

The distribution line project construction has been set up to be completed in one contract. The #2 12 kV overhead distribution line, will be replaced with an underground line, using #2/0 CU 15 kV cable. The new primary 6" and secondary 2" power conduits will be installed by the construction contractor. A portion of the primary conduit system under I-15 has already been installed by others.
  - b. The work will also include the installation of new padmounted transformers and cable switching stations.
  - c. Existing overhead services drops to the different buildings will need to be modified to provide underground service. In addition, there are some existing underground services that will be intercepted and modified. Both three and single phase services will be installed. Some buildings require new low voltage disconnect switches and/or meter bases in order to bring the electric service up to current electric code requirements.
3. Careful coordination between the Contractor, ICPE and the Prison Site Facilities staff will be required in order to systematically convert the system while maintaining electrical service to the buildings while minimizing electrical service outages to service buildings. It is anticipated that coordination meetings will be held during the project as required by construction progress needs. Construction sequencing, proposed switching and outage needs, coordination with other projects, and other project needs will be reviewed. The Contractor, ICPE, and Prison Site Facility staff will participate in these meetings. In addition, all changes to the work (if any) will be discussed, and monitor the impact of the construction on the prison operations.
4. All the material and equipment for this project is "contractor furnished". The contractor must construct a temporary fenced yard for the project material. It should be noted that all material and equipment removed from the project can be salvaged by the Contractor. Since the construction work is in the vicinity of the Utah State Prison, the Contractor is expected to comply with the Department of Corrections rules and regulations prepared for this project. Draper Prison Site Facilities department will be responsible for generally locating all buried utilities within the Utah State Prison. The contractor shall provide for accurate locating of buried utility services from the general information provided by the Site Facilities Staff. Utah "Blue Stakes" is to be contacted for the location of all other buried utilities outside of the Utah State Prison boundary.
5. The following is a general outline of the types of work that are included in this project. It should be noted that this list is intended to give an overall or general feeling of the type of work required, but may not include each item needed to complete this project. Refer to the drawings and specifications for complete project details. Also included in this section is a general outline of the required "sequence of events" for several portions of the project

6. NEW FEEDER INSTALLATIONS

- a. The existing overhead high voltage feeder will be replaced with a new underground high voltage feeder under this project. The main trunk feeders will be three, #2/0 CU 15 kV, tape shield, type EPR cables with a #2/0 CU 600V neutral. Five inch PVC conduit shall be used for all primary runs. Two inch conduit will be used for all electric service runs. Rigid galvanized steel conduits will be utilized for new feeder installation above the ground line. Plastic caution tape shall be placed over all primary feeders in the trench. A spare conduit is required on all primary feeders.

7. EXISTING FEEDER REMOVAL

- a. The existing overhead feeder will be replaced by the new underground circuit. It is anticipated to reuse the existing service conduits to the extent possible. Once a new service conduit has been constructed, it is expected that new service wire will be pulled into the conduit and connected.

8. PADMOUNTED EQUIPMENT INSTALLATION

- a. Seven cable switching stations (CSS) are involved in the complete underground project. Two of the cable switching stations are existing, CSS #30 by the west entrance under I-15, and CSS #34, by the Administration Building.
- b. The Contractor is to provide all materials associated with cable terminations as part of the project.
- c. The final location of the cable switching stations shall be determined by Prison maintenance personnel prior to the setting the equipment. Final approval of the equipment orientation shall be as approved by Prison personnel prior to installation.

9. TRANSFORMER ADDITIONS

|                      |            |           |                      |              |
|----------------------|------------|-----------|----------------------|--------------|
| Pump Building        |            |           |                      |              |
| Maintenance Building | Thee phase | 150 kVA   | 12470Y/7200x208Y/120 | Radial Fused |
| Training Building    |            | 112.5 kVA | 12470Y/7200x208Y/120 | Radial Fused |

- a. New service feeders and some modification to the service entrance equipment will be needed at each building location. At most locations transformer secondaries will terminate at existing panels in their respective building. New service entrance panels will be required at four locations. The Contractor will be responsible to dispose of the overhead transformers that are removed by the project.

10. BASIC SCOPE OF WORK

- a. CSS #30 to CSS #31 (Sheet E06)  
The primary feeder is installed under I-15 in an existing 6 inch conduit. The 6 inch conduit will need to be intercepted and routed to the cable switching stations at both ends of the crossing. The primary feeder will begin on the west side of I-15 at existing cable switching station #30. The primary feeder will end on the east side of I-15 at cable switching station #31.
- b. CSS #32 to CSS #34 (Sheet E07)  
The primary feeder is located along the existing overhead line route, approximately five feet west of the property line, marked by the steel fence posts. The primary feeder will be installed between the new CSS #32, the new CSS #33 and the existing CSS #34 that feeds the Administration Building.

- c. CSS #34 to CSS #36 [Fred A. House Academy] (Sheet E08)  
The primary feeder is located along the existing overhead line route, approximately five feet west of the property line, marked by the steel fence posts. The primary feeder will be installed between existing CSS #34, new CSS #35 and new CSS # 36 that feeds the Fred A. House Academy.

## 11. PROJECT COORDINATION & SEQUENCE OF EVENTS

- a. This section is intended to make the Contractor aware of some of the special sequencing requirements of some portions of the Project. However, it is not intended to outline each step that will be needed during the conversion process. Major points will be reviewed. The successful Contractor will be required to submit a very detailed plan within two (2) weeks of bid award, indicating how the Contractor proposes to convert each cable run to the new system configuration. The plan will be reviewed and approved by the Prison and ICPE.
- b. Distribution System Conversion
  - (1) The following is a brief outline of the requirements of some of the more difficult areas of the distribution system conversion or those areas that will need to be installed after the contract is awarded to the successful bidder. It is not intended to outline all of the work that is necessary for the project nor reflect an exact sequence of events.
  - (2) The distribution system is operated at 12.47Y/7.2 kV wye. The main feeders for existing electrical system of the prison are in a loop configuration. However, the area where the upgrade project will occur is a radial system.
    - (a) It is anticipated that only localized short outages will be required for the installation of the distribution system. The Contractor must use a construction procedure which will minimize the outage time required for the installation of various equipment.
    - (b) The basic project approach for the project will be to utilize a parallel circuit for the construction. The parallel system approach either means that the underground system would be completed and energized before any load transfer takes place, or use standby generators to provide a source to facilitate the electric service transfer.
    - (c) The project will require very close coordination with the Contractor and the prison site facilities management. Construction and switching procedures and timing will need to be approved and coordinated.
  - (3) The distribution line upgrade project is within the confines of the Utah State Prison. The contractor shall take steps to be vigilant to follow the code of conduct. The expectation is that the work shall proceed without incident, involving the contractors crews, the guards, or the inmates performing their tasks.
    - (a) The preparation of detailed transfer plans, planning the date of the transfer, and following the plan will be very important. The following people shall be kept informed of the status of the transfer plans: Greg Peay- 545-5629, Doug Wright – 545-5550.
    - (b) The location of buried utilities will be an important work task. The Prison maintenance staff will assist the Contractor in generally locating the buried utilities. However, the Contractor shall locate to his satisfaction, all the buried utilities before any digging on the site. The Contractor should anticipate encountering abandoned utilities.
- c. Transformer Change Out Locations
  - (1) Pump Building and Maintenance Building: The existing three phase transformer bank, are three 50 kVA pole mounted units. They will be replaced by a 150 kVA, three phase padmounted, fused, radial fed unit. New secondary cables will be installed to the pump building and maintenance building. Power outage at this site will be minimized by installing the concrete pads, and secondary circuits before changing the transformer.

- (2) Training Buildings: The existing three phase transformer bank is three 25 kVA pole mounted units. They will be replaced by a 112.5 kVA, three phase padmounted, fused, radial feed unit. Two new services will be required at this location. Two new meter main panels will need to be installed at each of the training buildings. The secondary service rack will be removed after the services have been transferred. Power outage at this site will be minimal because it is a training building and is used only occasionally.

## 12. CONTRACT AWARD

- a. The successful contractor will not be selected based on price alone. Contractor's qualifications, work experience on similar construction projects, availability of qualified personnel, and references will also be considered.
- b. Contractor shall, to facilitate the selection process, completely fill out the "Bid" form. Improperly or incompletely filled out forms will be cause for rejection of the bid.
- c. Contractor shall provide, as part of his bid, a listing of similar projects (minimum two projects) the Contractor has constructed within the last three years. List shall include, at a minimum, a description of the project, nature of work performed, total construction cost of the project, the name and phone number of the customers representative for the project, that is thoroughly familiar with the project, to be used as a reference, and Contractors supervisor/construction foreman for the project. Contractor must have constructed at least two similar high voltage underground distribution projects in the last three years in order to be considered. Contractor must indicate his compliance with this provision by checking the appropriate box on the bid form. Checking "No" or leaving the box blank will be cause for rejection of bid.
- d. Contractor shall provide, as part of his bid, the name of the person he intends to use as supervisor/construction foreman on the project and a single page resume detailing that persons qualifications and experience constructing high voltage underground distribution systems. This person shall be on the premises during construction and be responsible for daily construction activities. This person shall have a minimum of three years experience constructing high voltage underground distribution systems. Contractor must indicate his compliance with this provision by checking the appropriate box on the bid form. Checking "No" or leaving the box blank will be cause for rejection of bid.
- e. Contractor's bid will be evaluated on the "award of contract" clause and "qualifications" outlined in the Instructions to Bidders.
- f. The only information to be submitted at the time of the bid opening is the information required in the bid. Any inadvertent requirement stated in the specification section will not be required at the bid opening, and is to be brought to the attention of the Engineer immediately.

## 13. CONSTRUCTION UNIT COSTS

- a. Contractor shall provide, as part of the "Bid" form, a breakdown of construction costs into the construction units defined below. Each Construction Unit shall be designated by the letter of the group to which it belongs. The Contractor shall fill out all blanks, including those in the "No. of Units" column.
- b. Each Construction Unit consists of the complete installation of the described portion of the distribution system, as specified on the drawings, together with connections to associated equipment. Each construction unit represents all labor and material, including necessary accessories, completely installed, tested, and in satisfactory operation.
- c. Items of material in each Construction Unit shall be of the designated size, rating, type, voltage, or other specification in accordance with the drawings and specifications. The drawings and

specifications contain adequate identification of the equipment comprising the Construction Units and show what equipment items in the existing of the distribution system are to be reused or transferred on the distribution system (see drawings).

- d. Additional description to one or more of the Groups may be provided by the Engineer if deemed necessary to clarify the intent of these Specifications.
- e. The Construction Unit Groups are:
  - A. Primary Conduits
    - (2-5) New 5 inch and 4 inch conduit. New conduits includes the material and labor to install a complete high voltage ductbank system of the type, size and configuration as indicated on the drawings. The costs to modify and extend the existing conduit system as indicated are included in this construction unit. Primary conduits are to be red colored concrete encased as indicated.
  - B. High Voltage Equipment
    - (1-5) All of the padmounted or buried equipment are in this section. The construction units include the four position cable switching stations, and the three phase transformers.
  - C. Primary Conductor and Accessories
    - (1-2) 15 kV #2/0 copper feeders. The costs for these Construction Units include the labor and material for the installation of new high voltage feeders of the size noted. Cable configuration typically is three (3) 15 kV cables and one (1) 600V neutral as indicated in the drawings.
    - (3) Wire terminations and elbows. The costs for these units includes the labor and material for the installation of cable terminations and elbows on the primary feeders.
  - D. Secondary Service Installations
    - (1) Three phase services. This unit includes the removing the existing service conductors, modification of the existing three phase service conduit, pulling in the new service conductors, and terminating the service conductors in the existing electrical service panels.
    - (2) Single phase services. This Construction Unit includes the costs as described in section D.1 above, but for a single phase electric service.
    - (3) Disconnect Switches and Meterbases. The costs associated with the purchase and installation of disconnect and meterbases switches for new electric service.
  - E. High Voltage Cutover
    - (1) The costs to coordinate, advertise, and carry out load transfer from the overhead electric system to the new underground system.
  - F. Remove Facilities and Site Restoration
    - (1-2) Overhead line. The costs to remove the overhead line after the underground system has been constructed and the load has been transferred. The items include the wood poles, overhead transformers, phase wires, secondary wires, down guys and anchors, and service poles.

(3-4) The costs associated with the replacement and/or repair of existing lawns, trees, shrubs, flowers, etc. as well as the repair and/or replacement of the irrigation system to the areas affected by the construction of the project. Costs to repair curb, gutter, asphalt sidewalks, asphalt roadways, and parking lots should be included in this Construction Unit.

G. Miscellaneous: This unit includes the labor and material required for items not included above and having to do with the installation of new enclosures over existing communication ductbanks and cables.

(1) Bonding Costs: Costs associated with the required bonds for the project.

(2) Buried Utility Location. This item is for the cost to locate all the buried utility lines that may be crossed by the construction of the underground electric system.

(3-4) Other: The Contractor must specify what is included if these lines are used.

#### 14. LONG LEAD TIME MATERIALS

a. Long lead time materials are to be identified in the Contractors work plan schedule. Long lead time items may include, but are not limited to, pad mounted transformers, cable switching stations, high voltage cables and terminations.

#### 15. UNIT COSTS

a. The Unit Costs required on the Bid Form are to be installed costs, including all material and labor needed for the unit installation. Unit costs will be used if unforeseen conditions are encountered during the construction of the project. Changes may be either additive or subtractive from the Contract Award amount.

#### 16. OUTAGES

a. The Contractor must use a construction procedure and sequence which will minimize the outage time required for the installation of the various facilities. Coordination and timing of the outages are critical.

b. The following procedure is to be used:

- (1) A minimum of three (3) days written notice shall be given for requested outages of two hours or less in duration to any building and the outage is to be coordinated to fit Prison's schedule. For outages longer than two hours, seven (7) days written notice shall be given to the Prison Management.
- (2) All outages will be scheduled at the convenience of Utah State Prison. No assurance is offered that the requested date and time will be approved. Another date or time may be indicated based on Prison Site Facilities needs.
- (3) It is anticipated that all building outages will usually occur during non-standard hours. No extra costs will be paid for overtime work required. All costs must be included in the Bid Price.
- (4) Restoration of power must be at the time agreed upon and as coordinated with Prison Maintenance.
- (5) Where outages may be lengthy to change transformers, the Contractor may be required to provide sufficient manpower to allow for a continuous work effort to minimize outage duration.

c. The following indicates general building outage limitations:

- |                           |                 |                 |
|---------------------------|-----------------|-----------------|
| (1) Administration        | During weekends | 6 hours maximum |
| (2) Fred A. House Academy | During weekends | 6 hours maximum |

Outages after 5:00 p.m. may also be possible.

#### 17. HIGH VOLTAGE SWITCHING

- a. All high voltage switching shall be coordinated with Prison Maintenance personnel. Current switch status and configuration will be updated by Doug Wright. Requests for switching are to be received by Doug Wright seven days prior to the requested date and time.
- b. Due to the nature of the project, close communication will be needed between the Contractor, ICPE, and Prison Maintenance personnel to assure that everyone involved with the distribution system understands what load is being fed from where. Changes and proposed changes to the distribution system configuration will need to be reviewed in the coordination meetings.

#### 18. INSPECTIONS

- a. ICPE and Prison Site Facilities personnel will inspect the work performed throughout the course of the project.

#### 19. LOW VOLTAGE WORK

- a. Low voltage electrical work required by the project shall be done by a licensed electrical contractor.

#### 20. CONFINED SPACES

- a. The Contractor must comply with all applicable OSHA requirements when entering confined spaces (i.e. vaults, manholes, etc.)





# *Utah Department of Corrections*

## CONTRACTOR'S CODE OF CONDUCT

January 7, 2003

As an independent contractor working with or around inmates at the Utah State Prison, I understand and agree to observe the following policies:

1. While on duty, I will visually carry my ID with me.
2. I will respect and protect the civil and legal rights of all offenders.
3. I will be respectful, courteous and civil with staff and inmates, and shall not use coarse, loud, indecent, profane or unnecessarily harsh language nor do anything that might incite any person to violence while on the Institution premises-
4. I will meet standards established in my job description and report conditions or circumstances that would prevent me from performing my job effectively or completing my assigned asks, I shall bring to the supervisor's attention unclear instructions or procedures.
5. I will not engage in "horseplay" or playing of pranks while on the premises.
6. I will not violate any Federal, State or local laws or ordinances.
7. I will report any facts, information or evidence relating to a criminal offense or case in accordance with established department procedures.
8. I will not knowingly falsify, enter. or cause to be entered, any inaccurate, false or improper information on Institutional documents.
9. I will surrender all departmental property issued to me upon termination of my assignment.
10. I will give any department property or evidence that has been found or recovered to my immediate supervisor.
11. I will not consume, nor otherwise use any intoxicants, nor be intoxicated, while on Institutional assignments. I will not have in my possession any of these substances or any item they would impact the safety or control of the institution.
12. I will not bring any over the counter medications except for what is needed for that day, tobacco products, alcohol, firearms, ammunition or drugs onto prison property or to an inmate under jurisdiction of Utah State Corrections.
13. I will not fraternize with. nor develop personal relationships with offenders. When answering questions I will be brief, polite and to the point.
  - a. I will never discuss an offender's case with them except as a required part of my job.
  - b. I will not become involved socially with the offenders under custody or supervision of the department. Nor will I seek to be socially involved with an offender's family. If I choose to become involved socially with an inmate I understand that I will be suspended from the visiting

list for the inmate for 12 months and immediately removed from the project and will not be allowed to work on corrections controlled property regardless of the task.

- c. I will not compromise security as a result of communication or interaction with offenders.
- d. I understand that becoming overly and/or unnecessarily familiar with offenders is unwise.
- 14. I will immediately notify department personnel of any friendships or relationships that I have with an incarcerated offender or offender under the control and supervision of UDC.
- 15. I am prohibited from accepting loans gifts, gratuities, and/or other favors from offenders.
- 16. I will not loan/give money or other property to offenders; nor purchase or bargain for items belonging to offenders; nor sell any Item to offenders; nor enter into any business transactions with inmates of their families.
- 17. I am prohibited from discussing departmental or personal business with offenders I shall exercise proper caution at all times concerning what is said, to whom it is said, and who can overhear.
- 18. I will not discuss with offenders any issues involving other contractors, volunteers and/or Institutional staff. I will not become involved in any conflicts between inmates and/or inmates and staff.
- 19. If I have reason to believe that an inmate has valuable information he wishes to divulge, I will refer that inmate to the Institutional administration.
- 20. I will bring my concerns to the attention of my supervisor if I have reason to believe that any of the following situations have arisen or might arise:
  - a. development of inappropriate relationships with offenders, their families and/or their friends;
  - b. a conflict of interest situation and/or any situation from which personal gain may be obtained, or
  - c. questions arising from personal loyalties, beliefs, or values which might impair professional judgment or independence.
- 21. I will bring only authorized items that are necessary in the performance of the assigned duties into the institution. I will not take unauthorized personal items into nor out of the institution.
- 22. I will not carry out nor bring in letters, notes books, food or messages for inmates. I will not make purchases in the community for any inmate.
- 23. I will not bring any reading or pornographic material onto institutional property that is not specifically authorized by Department Policy or Department Administration.
- 24. I will report in writing incidents or occurrences involving an omission or violation of the rules, regulations and requirements set forth in the departmental policies and procedures.
- 25. I will not engage in religious discussions or debates to the detriment of good discipline, nor speak disparagingly of the nationality, race or beliefs of any person while on duty,

26. I will comply with the State Indoor Clean Air Act, UCA 76-10-106- I understand that smoking is allowed only in designated areas and will make certain I know where those areas are and comply with the current policy.
27. I will not use my Department of Correction's position or my official identification card for-
  - a. personal or financial gain;
  - b. Obtaining privileges not otherwise available to me.
28. I will not be permitted to take inmates out of the Institution for any reason except that which is authorized by the Institution's administration.
29. I understand that I will not be allowed use of tape recorders, video recording equipment and/or cameras unless first obtaining written approval from the warden or division director.
30. I shall not perform any act which constitutes a threat to the safety, welfare or health of self or others; that which substantially threaten the safety, security or control of the department is prohibited. Such prohibited conduct includes, but is not limited to:
  - a. improper use of equipment, material or supplies:
  - b. creating or contributing to unsanitary or unsafe conditions:
  - c. the unauthorized use, or possession of firearms, ammunition, explosives or incendiary devices on departmental property
  - d. the unauthorized use, possession or duplication of any, locking or restraining device or key.
31. I will maintain an inventory of all tools or devices that are necessary in the performance of my duty. This inventory will be used to account for tools and hardware used on institutional property at the end of work each day. Any discrepancy's will be immediately reported to internal security or other prison personnel. All items that could be used in an escape or aid in an escape will be secured off site outside of the secure perimeter at the end of each work day. All cutting tools including bolt cutters, wire cutters, hacksaws, carbide saws and diamond saws will be removed and secured outside the secure perimeter. Disposal of worn or damaged tools or cutting devices will be done outside of institutional property.
32. I will not interfere with any department business or work activities, or substantially distract or disrupt any member in the performance of their duties.
33. I understand that it is expressly prohibited for me:
  - a. to use state-owned or managed property or facilities in unauthorized ways;
  - b. to distribute or post any written or printed material, absent prior authorization,
  - c. to engage in any intentional slowdown, work stoppage, "blue flu" or strike;
  - d. to engage in any activity or business not departmental-related, either personally or as an agent of any other agency or organization, on department property or while on state time, absent prior authorization.

- e. to remove or alter any posted information absent prior authorization; and
  - f. to distribute or disclose confidential, private or privileged information.
34. In general, I understand and will observe normal workplace procedures and will comply with state and department administrative policies, procedures and regulations.
35. I understand that I will be subject to disbarment, from any institutional property and/or legal liability if it is found that I have participated in an act, conspired to commit an act, served as an accessory or accomplice in the commission of any act, or failed to report any act, which violates these rules and regulations, other department policies and procedures or the laws of the State of Utah or of the United States.
36. I have read and understand the code of conduct and agree to comply by signing this agreement.

Signature \_\_\_\_\_

Date \_\_\_\_\_

CONT\_CODE OF OD.DOC

# *Utah Department of Corrections*

## (DRAPER SITE)

### OUTSIDE CONTRACTOR RULES AND REGULATIONS

January 7, 2003

1. All contractors, workers, architects, etc. must have picture identification on their person while working at the Prison. A Utah Driver's License or Driver's License Division I. D. is preferred, but we will accept pictured military I. D., etc.
2. No unlocked vehicles may be left unattended.
3. No running vehicles may be left unattended.
4. No keys may be left in vehicles.
5. Park all vehicles and equipment away from fences - a minimum of 50 feet.
6. No blue chambray (light blue denim) or solid white work shirts may be worn.
7. No blue denim jackets may be worn.
8. Do not run - especially toward or away from any fence line.
9. Absolutely No "visiting" with inmates.
10. Nothing may be given to inmates. Giving contraband to inmates is a felony.
11. Nothing may be taken from inmates.
12. No tools may be left unattended. Unattended tools will be confiscated.
13. Do not throw away broken or worn out saw blades of any kind at the prison site. Dispose of them off property, at your home, shop, or office, or you may give them to the security officer.
14. Explosive cartridges for Hilti guns, etc. must be locked up and/or strictly supervised at all times. Cartridge "clips" shall be disposed of away from prison property. This also includes individual load shell casings. If you have a Hilti gun, etc. in your equipment, the gate security officer for your construction site must be notified.
15. No weapons, ammunition, explosives, drugs, alcoholic beverages, poisons, acids or other dangerous objects or hazardous substances are allowed on prison property. (Required prescription "medicines" can be carried in limited daily dosages only.) These items will be confiscated if found and appropriate action will be taken.
16. Anyone entering prison property is subject to search of his property, person, and vehicle. Failure to submit to this search will result in expulsion from prison property and/or arrest upon probable cause.

17. Any statutory or illegal contraband or other controlled items, as stipulated by this document, found on a person in a work area or in a vehicle will be confiscated. Vehicles may also be confiscated. Any item violating state law will result in an investigation and/or arrest by the prison Security personnel or local law enforcement agency. If any statutory or illegal contraband or other controlled items are returned to the prison a second time, access to prison property will be denied permanently.
18. Any person who the officer believes is arriving at the prison impaired by alcohol or drugs shall be denied access to prison property and may also be detained pending arrival of an Enforcement Officer who will determine if a citation or arrest is warranted.
19. When working inside the prison fence lines, all traffic is checked, searched, and cleared at our main truck gate sally ports. In order to help us expedite your traffic, all trips through the gates should be limited to those which are absolutely necessary. 'Car pooling' in company vehicles from the main prison parking areas into the construction site is required. When checking in through the prison gates, all workers in any and all vehicles must get out of the vehicle and stand next to it while it is searched and their identity is verified.
20. Private vehicles used primarily for transportation will not be allowed into construction sites. "Company" and/or primary "work" vehicles will be permitted.
21. Foot traffic into construction sites is encouraged when practical.
22. Driver's licenses or other picture I.D. of all workers will be taken at the gates to the construction sites for I.D. and control purposes. A temporary pass from that gate will be issued to be worn in plain sight while working on site. Upon departure from the work site, this temporary pass will be returned to the gate that issued the pass and personal drivers License or other Id will be returned upon exit.
23. In the event of a prison emergency, i.e., fire, escape, riot, etc., all construction sites will be secured and traffic to and from the sites halted. Work within the sites will be allowed to continue normally as long as there is no physical threat to the site(s). When the emergency has been verified and resolved, the site will be re-opened to traffic. If evacuation of a site is necessary, everyone will be expected to gather in one central location identified by the security officer, and then will be escorted off property by security personnel. All emergency situations will be resolved as soon as possible.
24. Work hours for construction within the prison fences will normally be limited strictly to daylight hours, Monday through Friday. If early morning, late evening, weekend, or holiday work is planned or needed, the project security staff must be contacted at least 24 hours in advance of approval.
25. Ex-inmates or parolees are normally not permitted to work on prison projects.

**NOTE:** Specific limitations may be listed as part of your project specifications. Report any known or suspected ex-inmates, parolees, or convicted felons to Doug Wright, Facilities Bureau at the Utah State Department of Corrections 545-5550.

All contractors, subcontractors, employees, and other personnel working on prison projects are subject to having a criminal identification check process. Anyone with a verified record of

criminal activity, deemed to pose a potential hazard to prison security, may be denied access to prison property.

26. Ladders may not be left unsecured in construction areas at night or on weekends, holidays, etc. when no work is going on.
  - a. Portable ladders must be removed from the work site and secured inside locked construction trailers or be secured outside of the fenced perimeter at the end of every work day.
  - b. Larger, heavier ladders and scaffolding may, with approval by internal security, be secured by chains and padlocks to immovable objects within the construction area, but safely away from all fences.

**NOTE:** Ladders which are not secured as per the above instructions will be confiscated.

27. Cutting torches and equipment shall not be left unattended in construction areas. All cutting torches, fuel tanks, etc. must be maintained on carts or vehicles and be removed from construction sites at the end of each work day,
28. Contractors will not be permitted to store flammable liquids or fuel tanks within the security fence perimeter. Contractors will be assigned a specific approved storage area for any such items on request.
29. No vehicles or motorized construction equipment may be left inside the security fence perimeter when no construction work is going on unless mechanically disabled and proper authorization is obtained in writing from UDC security.
30. Contractors are responsible to provide their own portable restrooms for construction sites. Contractors will not be allowed access to occupied prison facilities to utilize restrooms unless restrooms are located in the immediate work area.
31. Contractors will not be given access to the prison dining room for meals unless construction work is in the specific kitchen/dining room area and the Warden's and Support Services approval is granted in advance.
32. All contractors will be required to clean up all construction sites, debris and "extra" construction supplies from work areas on a daily basis. Construction debris must be hauled away immediately or placed in a designated disposal site at the prison. Extra construction supplies must be returned to the designated supply/construction yard or retained in construction vehicles until the next work day.
33. Contractors working at the Draper site on authorized bid projects are responsible to provide all of their own tools and equipment for the work involved in those projects. The prison will normally not permit contractor use of state-owned shops, tools, or equipment.
34. All contractors working at the Draper site are required to fully comply with all OSHA work safety requirements; take prudent precautions to protect the work site and adjacent facilities from damage; and to provide appropriate safety equipment, including fire extinguisher and other "fire protection. devices" for their work areas.

35. All contractors working at the Draper site are required to take reasonable precautions to avoid causing damage to the existing facility and its utility lines, etc. in the course of completing their authorized project. Special attention shall be given to utility lines that may be buried, or imbedded in walls, under floors, etc. The Draper maintenance staff will provide the best available information on what lines are known or suspected in any given area. The contractors are responsible to use due care to eliminate and/or minimize damages. When and if damage occurs, the contractors are required to cooperate fully with prison maintenance or other emergency personnel to assist with and expedite any repairs required to restore normal prison services and operations. Negligence or carelessness on the part of any contractor that results in all or part of any damage will result in that contractor being held liable for all or part of the damages. In all cases, the extent of any such liability will be negotiated with the primary or general contractor responsible for the project. In accepting the award of any project at the Utah State Prison, Draper site, the contractor also agrees to negotiate any such damages in good faith with prison representatives.
36. All planned interruptions to utilities (Water, sewer, gas, electrical, steam etc.) will require a written request to

Doug Wright , Facilities Coordinator,  
14717 So. Minuteman Dr.  
Draper, Utah. 84020

This request can also be faxed to Mr. Wright at (801) 545-5523

at least five working days prior to the scheduled outage or interruption. If an emergency occurs and the utility service needs to be interrupted to facilitate repairs or to prevent risk to life or property it is expected that all efforts be made to promptly respond and correct the problem, and notification to facility maintenance be done so emergency response can be in-acted to maintain order and proper operation of the institution.

If you have any questions regarding these regulations or need a special exemption, clarifications, etc., contact Doug Wright (801)-545-5550 office or (801) 557-2086 cell or by email at [dougwright@utah.gov](mailto:dougwright@utah.gov).

NOTE: These rules are subject to review and change at any time.





## SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK:

- A. The extent of electrical work required is indicated in the Contract Documents which include but are not limited to, the following specification sections:

1. 16010 Basic Electrical Requirements
2. 16110 Raceways
3. 16120 Wires and Cables (600V and Below)
4. 16125 Single Conductor Shielded Power Cable Rated 15 kV, EPR Type MV-105
5. 16126 Power Cable Installation Methods
6. 16127 Cable Marking and Location
7. 16130 Terminations, Splices, and Elbow Surge Arresters
8. 16150 Grounding
9. 16155 15 kV Cable Switching Station
10. 16159 Existing Equipment Disposal
11. 16215 Secondary Line Installation
12. 16220 Service Entrance Equipment
13. 16235 Electrical Boxes and Fittings
14. 16275 Circuit Disconnects
15. 16300 Three Phase Padmounted Distribution Transformer
16. 16422 Cast-in-place Concrete
17. 02450 Construction Barricade Standards
18. 02480 Landscape Restoration Work
19. 02810 Irrigation Restoration Work

#### 1.2 DEFINITIONS: The following are Division 16 document definitions:

- A. "Furnish": Purchase and deliver to project site.
- B. "Connect": Make all final electrical connections to a piece of equipment or device. This includes control wiring when shown or indicated.
- C. "Install": To furnish, connect and physically install the item.
- D. "Contract Documents": includes all applicable Division-16 drawings, specifications, and authorized changes (addendums, change orders, etc). They also include, but are not limited to, Architectural/Structural/Mechanical drawings, related Document/Section specifications and all authorized changes.

#### 1.3 INTERPRETATION OF CONTRACT REQUIREMENTS

- A. Prior to bidding, the contractor shall review all applicable Contract Documents and shall make as many site visits as necessary to become completely familiarized with existing conditions and proposed construction requirements. Include all demolition/renovation/new construction costs in bid.
- B. Address all requests for clarification to the Owner/Engineer in writing five (5) working days prior to bid opening to allow issuance of the final addendum.
- C. After the contract has been awarded and signed, the Contractor shall fulfill the intent and purpose of the Contract Document requirements. All costs pertaining to equipment, material devices, testing and labor necessary for the completion of the job shall be the responsibility of the Contractor and shall be included in the bid.

D. Additional costs due to inadequate site investigation or drawing/specification interpretation shall be the responsibility of the Contractor.

E. Conflict of Requirements:

1. If a conflict of requirements is found between Division 16 and other Divisions/Sections, the more stringent requirement will take precedence.

#### 1.4 ELECTRICAL IDENTIFICATION

A. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment.

1. Provide a single line of text, with ½ inch high lettering on a 1-1/2 inch high label (2-1/2 inch high where two lines are required), white lettering in black field. Labels shall be attached with stainless steel screws. Labels shall be attached with silicon rubber where screws are not possible due to oil or gas filled tanks.
2. Text shall match terminology and numbering of the Contract Documents, shop drawings and Draper Prison Site Utilities standard labeling methods.

B. Each cable be identified at its termination at each switch position. A listing of the cable and switch ID's will be provided by Draper Prison Site Utilities.

1. Cable labels shall be made of metal tags which are tie wrapped to the circuit feeder cables after fire taping has been applied. Also see cable installation requirements for additional information.

#### 1.5 CODE AND STANDARDS COMPLIANCE

A. The most current published and adopted edition of the following codes, standards and references are considered part of this specification:

1. Codes:

- (a) NEC - National Electric Code
- (b) NESC - National Electric Safety Code
- (c) NFPA - National Fire Protection Association
- (d) IBC - International Building Code
- (e) IFC - International Fire Code
- (f) IMC - International Mechanical Code

2. Standards:

- (a) AEIC - Association of Edison Illuminating Companies
- (b) ANSI - American National Standards Institute
- (c) ASTM - American Society for Testing Materials
- (d) ETL - Electrical Testing Laboratories
- (e) IEEE - Institute of Electrical and Electronics Engineers
- (f) IPCEA - Insulated Power Cable Engineers Association
- (g) NEMA - National Electrical Manufacturer's Association
- (h) UL - Underwriters' Laboratories

3. All electrical equipment furnished under Division 16 shall comply with all current applicable NEMA requirements and shall be UL listed and labeled.

B. State and Local Code Compliance

1. The Contractor shall comply with all State and/or Local code requirements. If a conflict of requirements is found between those and the contract documents/specifications, the more stringent requirement will take precedence and shall be provided.
2. The Contractor accepts responsibility for this upon bid submittal. All costs pertaining to this requirement shall be included in the bid and shall be the responsibility of the Contractor.

1.6 PERMITS/INSPECTIONS

- A. Obtain all permits, inspections, etc. pertaining to the completion of the job as required by the authority having jurisdiction and include all costs in the bid.
- B. Deliver all required certificates of approval to the Owner or Owners Representative upon completion of the project or upon the Owner's or Owner's Representative request.

1.7 QUALIFIED PERSONNEL/WORKMANSHIP

- A. The following are personnel/workmanship guidelines. They include, but are not limited to:
  1. The Contractor shall have an current applicable state contracting license for the type of work required under this contract.
  2. Provide a competent supervisor to oversee work at all times.
  3. Employ only qualified personnel with at least (3) years experience for the type of work required.
  4. Incompetent supervisors or personnel shall be discharged and replaced.
  5. Workmanship shall conform to the latest industry practices and shall have a neat, clean looking appearance.

1.8 MAINTENANCE AND OPERATION MANUALS

- A. Provide maintenance and operation manuals for all equipment provided under this Division in the following manner:
  1. Provide four (4) copies to the Engineer or Owner's Representative three weeks prior to completion of the project.
  2. Manuals shall include the following:
    - (a) A cover letter indicating a complete list of equipment contained in the manual.
    - (b) Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
    - (c) Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; summer and winter operating instructions, wiring diagrams and certified outline and shop drawings.
    - (d) Wiring diagrams, printed circuit card schematics, replaceable parts, manufacturer and catalogue numbers of items and equipment (sales cut sheets are not acceptable). Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
    - (e) Servicing instructions and lubrication charts and schedules.
    - (f) Names, addresses and phone numbers of vendors for each piece of equipment.
  3. All information shall be neat and legible.
  4. Manual binders shall have the project name on the binder spine. Location and the name and address of the contractor neatly labeled on a cover sheet inside the binder.
  5. Binders shall be appropriately sized to the information contained in it.
  6. All drawings shall be full drawn size. Provide one set of Diazo reproducible drawings, except 11" X 17" drawings may be Xerox reproducible.

## 1.9 RECORD DRAWINGS

### A. Drawing Requirements:

1. Maintain a set of Record Drawings for the project in the following manner:
  - (a) Show accurately dimensioned locations (from two reference points) of all buried or concealed work and equipment including, but not limited to, manholes, conduit, junction boxes, devices, etc. This includes change order and addendum items and all deviations from locations as shown on the Contract Documents.
  - (b) Neatly labeled daily updates and instructions/information shall be made on a set of Contract Drawing prints.
2. Provide Engineer with Field Record Drawings of applicable Contract Document drawings at the completion of the project and assist in the transfer of all the information from the field set of Record Drawings in a neat, easily readable manner. Include notes and instructional information as required to aid interpretation of project "as-built" conditions. Provide Draper Prison Site Utilities with corrected originals on electronic media.
3. Put the heading "Record Drawings" in 1" high block letters in the upper right hand corner of each sheet.

### B. Certification

1. On of the first sheet of the Record Drawings set, place the following certification statement:

The information contained in this set of "Record Drawings" is accurate and complete and hereby certified as correct.

\_\_\_\_\_  
(Name of General Contractor)

By \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_  
(Name of Electrical Contractor)

By \_\_\_\_\_ Date \_\_\_\_\_

2. Persons with the authority are to sign and date this certification.

### C. Delivery of Record Drawings

1. The complete and signed/dated set of electronic media Record Drawings shall be delivered to the Engineer no later than two (2) weeks after project completion.

## 1.10 STORAGE OF MATERIALS

- A. Store all materials (Transformers, cable switching stations, devices, equipment, etc.) in an area which will prevent damage. Completely cover to prevent accumulation or contact with dust, dirt, moisture or construction debris. Material damaged during storage or installation shall be repaired or replaced by the Contractor at no extra cost to the Owner.
- B. Store material in an area that will not block pedestrian or traffic flow; block or encroach upon exits or exit paths; or in a manner that could cause a safety hazard to anyone in the vicinity of the storage site.
- C. Material storage on site will be quite limited. Appropriate arrangements will need to be made with Draper Prison personnel to store materials.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Products and materials are specified by manufacturer name, catalog number and/or by description.
- B. Referenced Manufacturers catalog numbers or descriptions establish the minimum quality of materials or systems required for project completion.
- C. Except for ordinary wear and tear, replace or repair all equipment, devices or materials which develop defects within one year of project completion.
- D. The contractor shall inform the Owner/Engineer in writing of any discrepancies found between the intended function of equipment and equipment specified in the Contract Documents a minimum of five (5) working days prior to issuance of the final addendum. Failure to report any discrepancy (catalog numbers, discontinued items, etc.) does not relieve the contractor from providing equipment which shall conform to and fulfill the intent of the Contract Documents. Nor shall it be used as a condition to obtain additional funds from the Owner after the Contract is awarded.
- E. Nameplates:
  - 1. Each major component of equipment shall have a minimum the manufacturer's name, address, and catalog or style number on a nameplate securely attached to the item of equipment. Nameplates for individual items of electrical equipment shall be as specified in referenced publications and shall be provided on each item of equipment.
- F. Prevention of Corrosion:
  - 1. Metallic materials shall be protected against corrosion as specified. Aluminum shall not be used.
  - 2. Ferrous metal hardware shall be hot dip galvanized in accordance with ASTM A 12, and A 153.
  - 3. Rigid steel conduits installed in the earth shall be vinyl coated or field wrapped with .010 inch thick pipe wrapping plastic tape applied at a 50 percent overlay. Plastic tape is to be polyethylene or PVC with a minimum dielectric strength of 10,000 volts.
- G. The Contractor shall request all clarifications of Contract Document requirements in writing to the Owner/Engineer a minimum of five (5) working days prior to issuance of the final addendum.
- H. Upon request, provide samples of substitution or non-standard items.
- I. Items may not be substituted after the bid opening.

### 2.2 PRODUCT DATA SUBMITTALS

- A. Proof of Compliance:
  - 1. Where materials or equipment are specified to conform to the standards or publications, and requirements of ANSI, ASTM, AEIC, IEEE, NEMA, NFPA, or UL, or to conform to a Fed Spec., the Contractor shall submit proof that the items furnished under this section of the specification conform to the specified requirements. The label of, or listing in the Electrical Construction Materials Directory of UL or the manufacturer's certification or published catalog specification data statement that the items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance.

B. Shop Drawings:

1. After receiving complete material lists and before installation of any of these items, the Contractor shall submit complete shop drawings and such other descriptive data as the Engineer and Owner may require to demonstrate compliance with the contract documents. Shop drawings shall be submitted for the following items and such other items as the Engineer may direct:
  - (a) Primary Cable - 15 kV
  - (b) High Voltage Switchgear - Cable Switching Stations
  - (c) Cable Terminations
  - (d) Transformers
  - (e) Secondary Low Voltage Cable - 600 volt
  - (f) Cable Splices
2. If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the shop drawings. Approved departures shall be made at no additional cost to the Owner.

C. List of Equipment and Materials:

1. A complete itemized listing of equipment and materials proposed for incorporation into the work shall be submitted. Each such itemization shall include an item number, the quantity of items proposed, the name of the manufacturer and catalog # of each such item.

D. Quality Standards

1. Prior to submitting Shop Drawings for review, the Contractor shall verify that items submitted comply with the functional intent, proportional and construction requirements of items indicated in the Contract Documents.
2. Equipment shall also comply with all required installation and operating clearances.

E. Submittal Procedures

1. Submit product data submittals for items as required per each section of this specification division.
2. Submit eight (8) copies of Product Data submittals for review prior to ordering or installing any equipment.

F. Submittal Content

1. Each submittal shall contain a cover sheet with the following information:
  - (a) Name and location of the project.
  - (b) Electrical Engineer, Contractor and Subcontractor names, addresses and phone numbers.
  - (c) Supplier and/or Vendor name, address, and phone number.
  - (d) Submittal date.
  - (e) Revision or correction information.
2. Product data shall be published catalog material from the Manufacturer and shall contain the following information:
  - (a) Complete dimensional, installation, and functional information including required options and special features.
  - (b) Submittals shall only contain information relevant to equipment under review.
  - (c) Catalog sheets shall have the Contract Document call out designation written on it in the upper right hand corner.

- (d) Each item under review shall have its own catalog sheet.
- (e) Shop Drawings shall contain detailed,  $\frac{1}{4}'' = 1' 0''$  scaled plans, sections and elevations which shall clearly indicate equipment and its relationship to adjacent equipment and/or structural elements (i.e. Spectrum Transformer installation).

### 3. Certification

- (a) The cover sheet shall contain the following statement:

The product data contained in this submittal has been thoroughly checked in all respects and complies with all requirements, performance intents and standards of the Contract Documents and Specifications for this project.

Signed \_\_\_\_\_ (Name of Electrical Subcontractor)  
Date \_\_\_\_\_

### G. Submittal Rejection

- 1. If the Product data and/or Shop Drawing submittals do not comply with the requirements contained in this section, they will be returned for resubmission.

### H. Review Period

- 1. The Engineer has a minimum of two (2) weeks to review or rereview submittals after receiving them.

### I. Contractor Responsibility

- 1. Review and/or acceptance of the Product Data and/or Shop Drawings submittals does not relieve the Contractor from the responsibility to provide materials and systems which satisfy the intent, dimensional proportions, purpose and functional abilities of equipment or devices which are indicated on the Contract Documents.
- 2. The omission of noting errors or corrections by the Engineer on the submittals does not permit the Contractor to proceed in error or purchase, install or fabricate equipment or devices which do not satisfy the intent or requirements of the Contract Documents.
- 3. Regardless of any information contained in Product Data or Shop Drawings Submittals, requirements of the Contract Documents shall supersede any review of said submittals.

### J. Job Site Verification

- 1. Upon arrival of equipment to the job site, the Contractor shall verify that the equipment complies with the requirements of the Contract Documents.

## 2.3 PRODUCT SUBSTITUTION SUBMITTAL

### A. Substitutions will be considered only if the following requirements are met:

- 1. The Contractor shall supply two (2) copies of the proposed substitution submittal to the Owner/Engineer a minimum of five (5) working days prior to the bid date.
- 2. The submittal shall include:
  - (a) A cover letter which lists proposed substitution items by manufacturer name and catalog number which are cross referenced to specified equipment in the Contract Documents.
  - (b) Manufacturers published pictorial and specification material for proposed substitution items.
  - (c) References of customers including names, addresses of those responsible for the use, installation, and maintenance of the proposed substitution.
  - (d) Provide any additional information requested by the Engineer, in order for the Engineer to evaluate the substitution request.



## B. Contractor Responsibility

1. Upon submission of a substitution submittal, the contractor automatically assumes responsibility that the proposed substitutions are equal to those items specified in the Contract Documents in performance, functional intent, voltage, ratings, construction design and is compatible in dimensional characteristics, etc.
2. Acceptance of substitution items does not relieve the Contractor from providing equipment which complies with the intent of the Contract Documents. If substitution equipment or material are judged to be inadequate by the Owner/Engineer after the contract is awarded, the Contractor shall replace that equipment or material with the originally specified items at no extra cost to the Owner.

## C. Substitution Submittal Acceptance

1. Substitution Submittal acceptance will be issued only by addendum prior to the bid opening or by change order in the case of a discontinued item. Verbal acceptance by the Engineer will not be given nor shall conversations with the Engineer be construed as a basis to provide unapproved materials.

## 2.4 INCENTIVE BIDS

- A. Incentive bids are acceptable only if they are listed individually on the bid form as specific additions or deductions from the base bid and must be based on items specified or approved per addendum.

## 2.5 SPARE PARTS

- A. Provide all spare parts, lamps, fuses, etc., as required to the Owner/Owners Representative.

## PART 3 - EXECUTION

### 3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Final location for equipment and pads shall be coordinated with Draper Prison Site Utilities personnel.
- C. Refer to Manufacturers written equipment specifications for rough-in requirements.
- D. Contract Document Drawings are made at a small scale. Unless dimensions are indicated, equipment/devices are indicated in their approximate location. Coordinate locations with other trades and field verify all dimensions and locations.
- E. The Draper Prison Site Utilities Personnel will provide all utility information available concerning the project work areas and surroundings.

### 3.2 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
  1. Coordinate electrical systems, equipment, and materials installation with other building components or systems to avoid unnecessary cutting, drilling or channeling.
  2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide code required headroom.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install only approved systems, materials, and equipment. Conform to the intent of arrangements indicated by the Contract Documents. Portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other systems and components.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. The Contractor is responsible to verify the phase rotation at each building and service before and after the transformer conversions or transformer replacements are made. The phase rotation before and after must match. Any damage to Draper Prison Equipment resulting from reverse phase rotation will be the sole responsibility of the Contractor.
12. Draper Prison requires (in addition to the NEC requirements) a minimum of four foot (4') clearance in front of all electrical equipment or the clearance to swing the door 180 degrees, whichever is greater. Where high voltage cables are terminated, 10' of clear space shall be provided.

### 3.3 CUTTING AND PATCHING

#### A. General: Perform cutting and patching in accordance with the following:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
  - (a) Uncover Work to provide for installation of ill-timed Work.
  - (b) Remove and replace defective Work.
  - (c) Remove and replace Work not conforming to requirements of the Contract Documents.
  - (d) Remove samples of installed Work as specified for testing.
  - (e) Install equipment and materials in existing structures.
  - (f) Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

### 3.4 EXCAVATIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
2. Subbase: as used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
3. Subgrade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.
4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Engineer.

B. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services which transit the area affected by selective excavation.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
3. Site Information: The Owner will not be responsible for interpretations or conclusions drawn from any subsurface condition reports.
4. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Damages to existing utilities shall be repaired by the Contractor at no cost to the Owner.
5. Obtain a digging permit from the Draper Prison before any excavation is begun. The permit will show all known utilities.
6. Remove existing underground utilities indicated to be removed.
  - (a) Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
  - (b) Provide temporary utility services to affected areas. Provide minimum of seven (7) working days notice to Owner and, if required, Utility Company prior to utility interruption. (Note: fourteen (14) days may be required for extended outages longer than two (2) hours.)
  - (c) Proceed with utility interruption only after receiving written authorization from the owner and, if required, Utility Company. Keep all outages to a minimum.
  - (d) Refer to the General Project Description and Requirements for outage request procedures and requirements.
7. Use of explosives is not permitted.

C. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

D. Soil Materials

1. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
2. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.
3. Backfill and Fill Materials: Excavated or borrow material complying with ASTM D2487 soil classification groups GW or SW, with the fine fraction between 5%-10% and free from stones in excess of 2" in any dimension; debris; waste; frozen materials; and organic or other deleterious matter.

## E. Excavation Procedures

1. Protect persons at excavation sites by providing barricades, warning signs and lights as necessary to prevent personal injury or equipment damage.
2. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
3. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
  - (a) Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
4. Install sediment and erosion control measures in accordance with local codes and ordinances.
5. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
  - (a) Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
  - (b) Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
6. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
  - (a) Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
  - (b) Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
7. Trenching: Excavate trenches for electrical installations as follows:
  - (a) Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of raceways and equipment.
  - (b) When conduits are installed between manholes, they shall be graded to drain towards the manholes whenever possible. The minimum slope necessary to accomplish this is three (3) inches per 100 feet of conduit.
  - (c) Excavate trenches to depth indicated or required per NEC 300-5 or State requirements, whichever is the most stringent. (36" minimum to top of concrete, except by written approval when 30" to the top of the duct or conduit may be permitted for conflicts.)
  - (d) Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
  - (e) Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
8. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (2 deg C).
9. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
  - (a) Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
  - (b) Under building slabs, use drainage fill materials.

- (c) Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
  - (d) No raceways shall be installed less than 30 inches below surface of groundline, sidewalks or roadways.
  - (e) Other areas, use excavated or borrowed materials.
10. Backfill excavations as promptly as work permits, but not until completion of the following:
- (a) Inspection, testing, approval, and locations of underground utilities have been recorded.
  - (b) Removal of concrete formwork.
  - (c) Removal of shoring and bracing, and backfilling of voids.
  - (d) Removal of trash and debris.
11. Placement and Compaction: Place and compact backfill and fill materials in layers of 8 inch maximum lifts. Thinner lifts may be required depending on materials and compaction effort.
12. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
13. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
14. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
- (a) Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (friction-cohesive soils), determined in accordance with ASTM D 1557.
    - 1) Areas Under Structures, Building Slabs, Walks and Steps, Pavements: Scarify and compact top 12 inches of subgrade and each layer of backfill or fill material to 95 percent maximum density for friction-cohesive material.
    - 2) Other Areas: Scarify and compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for friction-cohesive soils.
  - (b) Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
  - (c) The Contractor is responsible for the ultimate success of the compaction effort and overall project quality control. The Owner will perform tests to verify and monitor the soil compaction periodically. The presence of the Owners testing personnel and their findings does not relieve the Contractor of responsibility for the unsuccessful performance of the fill and compaction portion of the work. The cost of the first test performed in each area by the Owners testing representative will be paid by the Owner. However, cost of failed tests will be deducted from the Contractors pay request and/or retention fund. The Contractor is to notify the Engineer two (2) days prior to backfilling operations to allow for arrangements of testing personnel to be on site. The Contractor is to cooperate and work with the Engineer and soil testing personnel by providing clear and convenient access to the work at any time while the compaction work is being performed.
  - (d) A test schedule for all improvements shall be specified.
    - 1) Curb and gutter with grade less than 0.5%: one random test per lift per 200 lineal feet.
    - 2) Curb and gutter with grade greater than 0.5%: one random test per lift per 400 lineal feet.
    - 3) Sidewalk: one random test per lift per 400 lineal feet.
    - 4) Trenches: one random test per lift per 200 lineal feet.

- 5) Roadways: one random test per lift per 1000 square yards.
  - 6) Landscape Areas: no specific requirements.
15. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.
  16. Refer to Section 02480 and 02810 for landscape and irrigation restoration requirements.

F. Backfill – Cultivated Areas

1. The top 24" of excavated soil shall be kept separate from the remaining excavation.
2. The topsoil shall be used to backfill the top 24" of the trench backfill operation.
3. The intent of this section is to maintain high quality soil in cultivated area.

3.5 FIRE PENETRATION SEALS

- A. Seal all penetrations through fire rated floors, ceilings, or walls for work required under this Division to prevent the spread of fire, toxic gases, smoke, or water through the seal either before, during or after a fire per NEC 300-21.
- B. The fire rating of the seal shall match or exceed that of the floor, wall or ceiling which it serves.
- C. Comply with all manufacturers written instructions pertaining to the use and installation requirements of fire seal/barrier products and/or systems.

3.6 INACCESSIBLE EQUIPMENT

- A. Where the Engineer determines that the Contractor has installed equipment not "conveniently" accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
- B. "Conveniently accessible" is defined as being capable of being reached without the unnecessary use of ladders, and without unnecessary climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and ductwork.

3.7 UTILITY DISRUPTIONS

- A. Utility disruptions (power, telephone, etc. ) required for the completion of the project shall be coordinated in the following manner:
  1. For outages two (2) hours or less, contact the Owner a minimum of seven (7) working days prior to the proposed outage in writing.
  2. For outages more than two (2) hours, contact the Owner a minimum of fourteen (14) working days prior to the proposed outage in writing.
  3. Outage to be coordinated and scheduled at a time convenient with the owner.
  4. Obtain written permission from the Draper Prison before disrupting the service.
  5. Include all overtime costs for this requirement in the bid.
  6. It is anticipated that building shut downs for primary connection change over and other work requiring building outages will need to be performed during non-standard working hours.
  7. All cable switching procedures must be approved and will be coordinated with Draper Prison personnel.
  8. Refer to General Project Description and Requirements for other outage and switching requirements.

## PART 4 - PROJECT COMPLETION AND START-UP

### 4.1 SYSTEMS CERTIFICATION

- A. Assemble all applicable equipment Factory Representatives and Subcontractors at the project site for systems start-up and testing.
- B. Representatives shall assist in their respective system's start-up and testing and shall remain until their system has been accepted by the Owners Representative.
- C. The Factory Representative shall also personally instruct the Owners maintenance and/or operation personnel to the operation and maintenance of their equipment.
- D. The Owners Representative shall receive complete instruction pertaining to the operation and maintenance of all systems involved.
- E. The Contractor shall prepare a written certification as follows:

This certifies that the system subcontractor and Factory Representative listed below have fully instructed the Owners Representative and operational/maintenance personnel to the use and maintenance of their respective systems.

SYSTEM

(List systems)

\_\_\_\_\_  
Owners Representative

\_\_\_\_\_  
Contractor

FACTORY REPRESENTATIVE

(List names and addresses)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

- F. One copy of this signed and dated certification shall be sent to the Engineer. The original shall be given to the Owners Representative.

### 4.2 FINAL REVIEW

- A. During the final project review, the Project Foreman shall accompany the reviewing party and, upon request, remove coverplates, panel covers, etc. to allow inspections of any portion of the electrical system.

END OF SECTION 16010

## SECTION 16110 - RACEWAYS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. This is a Division 16 Basic Materials and Methods section and is a part of each Division 16 section referencing to raceways specified in this section.

#### 1.2 SUMMARY

- A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:
  - 1. Rigid galvanized conduit (RGC).
  - 2. Electrical metallic tubing (EMT).
  - 3. Rigid nonmetallic conduit (RNC).
  - 4. Ductbanks

#### 1.3 SUBMITTALS - None Required.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
- B. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- C. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

#### 1.5 MANUFACTURERS

- A. Provide raceways and raceway components from firms regularly engaged in manufacturing the types of raceway indicated and/or required and whose products have been used satisfactorily in similar usage for a minimum of five (5) years.

### PART 2 - PRODUCTS

#### 2.1 METALLIC CONDUIT AND TUBING

- A. Provide conduit in sizes indicated on drawings and/or specifications with all required fittings, bushings, couplings, etc. Minimum conduit trade size allowable is 3/4".
- B. Rigid Galvanized Conduit (RGC): ANSI C80.1.

Note: Aluminum conduit is not acceptable for any application.

- C. Electrical Metallic Tubing and Fittings: ANSI C80.3



## 2.2 UNDERGROUND METALLIC CONDUIT

- A. Portions of the ductbanks for conductors may be direct buried rigid galvanized conduit. These conduits shall have a protective coat of spirally wrapped PVC tape or a factory applied vinyl coat. Completely wrap and tape all field joints. Provide spacers as needed to allow for proper duct bank installation, backfill, and function.

## 2.3 NONMETALLIC CONDUIT AND DUCTS

- A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40.
- B. Underground PVC Plastic Utilities Duct: Schedule 40 for encased burial in concrete.
- C. PVC Plastic Utilities Duct Fittings: NEMA TC 9; match to duct type and material.
- D. Conduit, Tubing, and Duct Accessories: Types, sizes, and materials complying with manufacturer's published product information. Mate and match accessories with raceway.
- E. All PVC conduit shall be rated for use with 90° C conductors.

## 2.4 CONDUIT BODIES

- A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.
- B. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.
- C. Conduit Bodies 1 Inch and Smaller: Use bodies with compression- type EMT connectors.
- D. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514 B.

## 2.5 DUCTBANK CONSTRUCTION

- A. Ductbanks shall be concrete encased to be constructed as indicated using 2,500 psi at 28 day strength concrete. Use Type II low alkali per ASTM C150 and ASTM C-33 aggregate gradation with a maximum size of 3/4". Water/concrete ratio to be 0.50. Where "cold" joints occur in the concrete placement install #4 reinforcing bar per ASTM 615 grade 50 in each corner of the ductbank. Provide 200 lb. polypropylene pullrope in each spare duct with an excess of 48" at each end.
- B. Duct and Conduit Caulking Compound: Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F., shall not slump at a temperature of 300 degrees F., and shall not harden materially when exposed to the air. Compounds shall readily calk or adhere to clean surfaces of asbestos-cement, fiber, or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Provide plastic plugs in both ends of all unused ducts and seal with silicon sealant.
- C. Duct and Fittings, Nonmetallic Type for Installation Underground: Wall thickness and fittings shall be suitable for the application. Ducts shall be single, round-bore type. Ducts shall be of the same material when used for applications requiring the same type of wall thickness.
- D. Requirements: Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes.

Manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable and shall be galvanized steel. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends as required, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with malleable steel end bells whenever duct lines terminate in switches or handholes. All bell ends shall be grounded. Duct line markers shall be provided as indicated at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures.

- E. Treatment: Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. After a duct line is completed, a standard flexible mandrell shall be used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches long and have diameters 1/4 inch less than the inside diameter of the duct being cleaned. Mandrel pulls shall be witnessed by the engineer and authorized Draper Prison representative. Engineer should inspect duct bank construction before concrete is poured. Provide polypropylene pull rope in each unused duct. Pneumatic rodding may be used to draw in lead wires. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.
- F. Concrete Encasement: Each single duct shall be completely encased in concrete with a minimum of 3 inches of concrete around each duct, except that only 2 inches of concrete are required between adjacent electric power ducts. Duct spacing shall comply with NEC requirements, Article 310 (7.5" typical). Duct line encasements shall be for power ducts. Duct line encasements shall be monolithic construction. The top of the ductbank shall be dyed red. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. Any point tops of concrete encasements shall be not less than 36" below finished grade or paving. Separators or spacing blocks shall be made of plastic placed not further apart than 8 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.
- G. Installation of Couplings: Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved. In the absence of specific recommendations, various types of duct joint couplings shall be made watertight as specified.
  - 1. Plastic Duct: Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Solvent to be a two part solvent weld of the slow setting type for ducts over three (3) inches. Each duct and fitting shall then be slipped together with a quick one quarter turn twist to set the joint tightly.
- H. Raceways penetrating foundations, slabs on grade, footings, etc. shall be RGC with a plastic wrap or vinyl coating for a minimum of 10 feet beyond the structural element before a transition to PVC is permitted.
- I. Use O-Z/Gedney (or equal) conduit sealing bushing for all tunnel penetrations.

## PART 3 - EXECUTION

### 3.1 WIRING METHOD

A. Outdoors: Use the following wiring methods:

1. Exposed: rigid galvanized conduit.
2. Underground: rigid nonmetallic conduit, and as indicated on drawings.
3. Connection to Vibrating Equipment: Including hydraulic, pneumatic or electric solenoid or motor-operated equipment: liquidtight flexible metal conduit.

B. Indoors: Use the following wiring methods:

1. Use conduit type indicated in the drawings.
2. Exposed: electrical metallic tubing.
3. Concealed: electrical metallic tubing, electrical nonmetallic tubing, or rigid nonmetallic conduit.

### 3.2 INSTALLATION

- A. General: Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements of NEC, NECA, and as follows:
- B. Complete installation of electrical raceways before starting installation of conductors within raceways.
- C. Provide supports for raceways as required elsewhere in Division 16.
- D. Prevent foreign matter from entering raceways by capping ends.
- E. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- F. Do not exceed manufacturer's written instructions concerning maximum bending radius limits. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- G. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location.
- H. Run concealed raceways with a minimum of bends in the shortest practical distance.
- I. Where nonmetallic conduit or tubing is used, raceways must be converted to RGC before rising above equipment or floor slab.
- J. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
- K. Join raceways with fittings designed and approved for the purpose and make joints tight. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
- L. Tighten set screws of threadless fittings with suitable tool.
- M. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

- N. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- O. Install pull wires in empty raceways. Use no. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 48 inches of slack at each end of the pull wire.
- P. Stub-up Connections: Extend conduits through concrete equipment or floor slabs for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with RGC.
- Q. Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet locations. Install dedicated ground conductor in flexible conduit.
- R. Comply with NEC requirements concerning pullbox installations.
- S. Minimum burial depths of concrete encased conduit shall be a minimum of 36" or comply with NEC Section 300-5; whichever is the most stringent per the application (also see 2.5F of this Section).
- T. Provide rigid galvanized conduit (RGC) for all elbows and offsets in duct runs. Metal raceway in direct contact with earth or fill of any kind shall have a protective coat of spirally wrapped PVC tape or a factory applied vinyl coat. Completely wrap and tape all field joints. All bends for buried conduits must be approved by the Engineer before installation. Only wide sweeps where shown on the drawings are allowed, and should be formed with the "natural" bend of the PVC conduit, unless approved otherwise.
- U. All conduits shall have a 6" wide yellow plastic marker tape placed 12" above the top of conduit bank the entire length of the conduit. Tape shall indicate "Electric Line Below".

### 3.3 ADJUSTING AND CLEANING

- A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris. Replace all crushed, deformed or damaged raceways prior to installing wiring.

### 3.4 USE OR REUSE OF EXISTING DUCTS

- A. Where an existing spare conduit is indicated to be used, or where an existing cable is to be removed and a new cable is shown to be installed in the reused conduit, the Contractor is responsible to inspect and verify that the conduit(s) to be used are suitable for the successful installation of the new cable. All existing ducts that are to be used need to be inspected for blockages, burrs, and debris before installing wire.
- B. Conduits must be thoroughly cleaned to remove all dirt and other foreign substances before the installation of the new cables. A standard flexible mandrell shall be used for cleaning followed by a brush with stiff bristles. Mandrells shall be at least 12 inches long and have diameters 1/4 inch less than the inside diameter of the duct being cleaned.
- C. Existing conduits which are found to be crushed, deformed, broken, or damaged should be brought to the attention of the Engineer as soon as possible. The Engineer will review with the Draper Prison and the Contractor the problem found and provide the Contractor with instructions on how to proceed. Damaged raceways are not to be used for the installation of new cables.
- D. All costs associated with the inspection, cleaning, and use of existing spare or reused conduits are to be included in the project bid.

- E. The requirements for new conduit installation and use, as indicated above, apply to the use or reuse of existing conduits to the extent possible.
- F. Cable damaged by conduit improperly inspected or cleaned by the Contractor shall be removed and replaced by the Contractor at the contractor's expense.

END OF SECTION 16110

## SECTION 16120 – WIRES AND CABLES (600V AND BELOW)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. This section is a Division-16 Basic Materials and Methods section and is a part of each Division-16 Section referencing to wires and cables specified in this section.

#### 1.2 SUMMARY

- A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following:
  - 1. Wires and cables shall comply with current applicable NEC, IEEE, ANSI, ASTM and NEMA/ICEA requirements pertaining to materials, construction, sizing installation, performance and testing. All products shall be UL listed and labeled.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Provide wire and cable suitable for the temperature, conditions and location where installed. Size all conductors per NEC requirements and as indicated.

#### 2.2 CONDUCTORS

- A. Provide solid conductors for power and lighting circuits no. 10 AWG and smaller. Provide stranded conductors for sizes no. 8 AWG and larger. Minimum conductor trade size shall be #12 AWG.
- B. Conductor Material: Copper for all wires and cables.
- C. Insulation: THWN, THHN, or XHHW-2 as noted on the drawings (XHHW-2 shall be used on all service entrance conductors and for neutral conductors installed with high voltage feeders).
- D. 600V insulation shall be used on all low voltage cables.
- E. Provide single conductor cables as indicated in the drawings.

- F. Color code station service, feeder, and branch circuit conductors with factory applied color as follows:

| <u>120/208 Volt</u> | <u>Phase</u> | <u>277/480 Volt</u> |
|---------------------|--------------|---------------------|
| Black               | A            | Brown               |
| Red                 | B            | Purple              |
| Blue                | C            | Yellow              |
| White               | Neutral      | White               |
| Green               | Ground       | Green               |

- G. Phase rotation is to be ABC unless found and verified to be otherwise.
- H. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.

### PART 3 - INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires, and connectors in compliance with NECA/NEC, written manufacturers instructions and recognized industry practices.
- B. Coordinate installation with other Work and equipment installation to insure proper interface. Pull conductors simultaneously where more than one is being installed in same raceway. Use only UL listed pulling compound or lubricant recommended by the wire or cable manufacturer being used. Use pulling means including, fish tape, cable, pulling eyes, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable. Do not exceed manufacturers written instructions concerning maximum allowable pulling tension or bending radius.
- C. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A (Copper) and UL 486B (Aluminum).
- D. Follow manufacturers written instructions for splicing and cable terminations. Keep conductors splices to minimum. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating and type than conductors being spliced. Use splice and tap connectors which are compatible with conductor material. Splice cables and wires only in junction, outlet and pullboxes; manholes and handholes. Splices are not allowed in conduit bodies. Unsatisfactory splices and/or terminations (as determined by the Engineer) shall be corrected as required at no extra cost to the owner.
- E. Parallel conductors for the same phase shall be cut to identical lengths prior to installation in conduits. Parallel conductors are not to be cut after installation in the duct.

#### 3.2 FIELD QUALITY CONTROL

- A. Prior to energizing, test wires and cables for electrical continuity and short circuits. Use a megohm meter to meter circuits and determine required insulation resistance levels for circuits over 100A. Correct deficiencies. Submit test results to Engineer.

END OF SECTION 16120

SECTION 16125 - SINGLE CONDUCTOR SHIELDED POWER CABLE RATED 15 kV,  
EPR TYPE MV-105

PART 1 - GENERAL

1.1 SCOPE

- A. This specification covers single conductor shielded power cable insulated with an ozone and discharge resistant, flexible, rubber-like thermosetting dielectric.
  - 1. The cable shall be suitable for use in wet and dry locations in conduit, underground duct systems, direct buried and aerial installations. The cable shall be rated 105C for normal operation, 140C for emergency overload operation and 250C for short circuit conditions. Emergency overload operation may occur for periods up to 1,500 hours cumulative during the life of the cable.

1.2 OPERATING EXPERIENCE

- A. The medium voltage power cable supplied shall have a performance record demonstrating a minimum of twenty (20) years successful operation experience in utility and industrial power cable applications.

1.3 BASIC CONSTRUCTION

- A. MC-105-1/C Class B strand copper conductor, triple tandem extruded semiconducting rubber strand shield, EPR Insulation extruded, semiconducting rubber insulation shield, copper shield tape and a jacket overall.

1.4 INDUSTRY STANDARDS

- A. Cables shall meet or exceed the applicable latest editions of the following industry specifications:

- 1. ICEA S-68-516 (up to 35kV)
- 2. ASTM B-8, B-231
- 3. AEIC CS-6
- 4. UL-1072 (Type MV-90)
- 5. IEEE 400-1980
- 6. NEMA WC7, WC8
- 7. Federal Register, Section 10CFR50, Appendix B
- 8. ANSI N45.2
- 9. IEEE 48-1990
- 10. IEEE/IPCEA Power Cable Ampacities, IEEE S-135
- 11. AEIC-I-68

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical cable and connectors for use at the specified voltage. Submit certificate of compliance indicating that cable has been tested in accordance with ICEA S-68-516, AEIC CS6 and UL Standard 1072, and meets or exceeds minimum requirements.
- B. Installed Cable Field Test Data: Submit test data in accordance with IEEE Standard 400-1980 showing ambient conditions, voltage levels, level durations and conduction current for each step. Include effective insulation resistance in submittal.



## PART 2 - PRODUCTS EPR CABLES

### 2.1 CONDUCTOR

- A. Uncoated soft copper wire, Class B, stranded compressed concentric round. Copper per ASTM B-8.
- B. Conductors shall meet the electrical resistance requirements of ICEA S-68-516, Section 2.5.

### 2.2 CONDUCTOR SHIELD

- A. Extruded layer of semiconducting EPR thermosetting compound with a volume resistivity not in excess of 10 ohm meters at 90C shall be applied over the conductor. The compound shall have a minimum elongation after an air over test at 121C for 168 hours of 100% and a brittleness temperature not warmer than -50C.
- B. The shield shall be clean stripping from the conductor and inseparably bonded to the overlying insulation.
- C. The thickness of the extruded conductor shield shall be as shown in Table I. The thickness of the shield shall be measured and controlled by means of a laser detector.

TABLE I

| <u>Conductor Size - AWG/kcmil</u> | <u>Conductor Shield Thickness</u> |                            |
|-----------------------------------|-----------------------------------|----------------------------|
|                                   | <u>Min. point (mils)</u>          | <u>Min. Average (mils)</u> |
| 8 - 4/0                           | 12                                | 15                         |
| 250 - 500                         | 16                                | 20                         |
| 600-1000                          | 20                                | 25                         |

### 2.3 INSULATION

- A. The insulation shall be based on an ethylene propylene elastomer. The ethylene content of the elastomer used in the insulation compound shall not exceed 72% by weight of ethylene. Also, any processing agent utilized to mix the formulation shall be widely dispersed to prevent susceptibility to treeing. The insulation shall be compounded by the cable manufacturer in its own facility using a closed system to insure maximum cleanliness. All ingredients shall be thoroughly mixed and treated with the accelerator or cross linking agent to insure complete blending and uniformity of the final compound.
- B. The minimum average insulation thickness shall not be less than Table II. The minimum thickness at any cross section of the insulation shall not be less than 90% of the specified minimum average thickness.
- C. The insulation shall be triple tandem extruded with the conductor and insulation shield to prevent intersurface contamination. The extrusion operation shall be performed by three separate in line extruded heads thereby permitting the measurement and accurate individual control of the wall thickness of each layer of compound as the cable is being manufactured.

TABLE II

| Rated Voltage<br>Phase to Phase<br>kV | Conductor<br>Size  | Minimum Average<br>Insulation Thickness<br>mils - 133% | 5 minute ac<br>Withstand KV | 15 minute dc<br>Withstand kV |
|---------------------------------------|--------------------|--|-----------------------------|------------------------------|
| 15                                    | #2 to 1,000<br>MCM | 220  | 44                          | 80                           |

## 2.4 INSULATION SHIELD

- A. The insulation shield shall be an extruded semiconducting compound with a volume resistivity not in excess of 10 ohm-meters at 90C when tested per AEIC No. CS-6. The material shall be chemically and thermally compatible with the insulation.
- B. The extruded shield shall be clean stripping and shall have a peel strength from the insulation between 6 and 24 lbs./0.5 inch width when tested per AEIC No. CS-6. This compound shall have a minimum elongation after an air over test at 121C for 168 hours of 100% and a brittleness temperature not warmer than -50C.
- C. The thickness of the extruded shield shall be in accordance with the following:

| Minimum Insulation Diameter<br>(Inches) | Insulation Shield Thickness (mils) |            |
|---|------------------------------------|------------|
|   | Min. Point                         | Max. Point |
| 0 - 1.000                               | 30                                 | 70         |
| 1.001 - 1.500                           | 40                                 | 85         |
| 1.501 - 2.000                           | 55                                 | 100        |
| 2.001 & Over                            | 55                                 | 115        |

- D. The outer surface of the insulation shield shall be continuously printed with contrasting ink - "Semi conducting - Remove When Splicing or Terminating".

## 2.5 METALLIC SHIELD

- A. The extruded shield shall be covered with an uncoated copper tape. It shall be applied helically with a 12-1/2% minimum overlap.

## 2.6 JACKET

- A. The overall jacket shall be black PVC (polyvinylchloride).
- B. The jacket thickness shall be as shown in Table III.

TABLE III

| Cable Diameter Before Jacket<br>(inches) | Jacket Thickness Minimum Average<br>(mils) |
|--|--|
| 0 - 0.425                                | 45   |
| 0.426 - 0.700                            | 60   |
| 0.701 - 1.500                            | 80   |
| 1.501 - 2.500                            | 110  |
| 2.501 & larger                           | 140  |

- C. The minimum thickness at any point shall be not less than 80% of the specified minimum average thickness.

## 2.7 IDENTIFICATION

- A. A permanent marker tape indicating "cable manufacturer, plant number, year of manufacture and sequential footage number" repeated each foot shall be inserted under the copper shielding tape.
- B. An identifying legend shall be printed on the jacket with contrasting ink repeated at two (2) foot intervals with unmarked surfaces not exceeding six inches. The legend shall provide the following information:
  - 1. Manufacturer name and plant code
  - 2. Conductor Size - either AWG or kcmil
  - 3. CU
  - 4. Voltage
  - 5. Insulation Percent
  - 6. Insulation Thickness
  - 7. Insulation Type
  - 8. Footage at 2 ft. intervals

## 2.8 PRODUCTION TESTS

- A. Conductors shall meet the electrical resistance requirements of ICEA-68-516 Section 2.5.
- B. Insulation Resistance test shall be performed in accordance with the requirements of ICEA S-68-516, Part 6.28. Each cable shall have an insulation resistance not less than that corresponding to the insulation resistance constant of at least 50,000 megohms-1000 ft. at 15.6C.
- C. A high voltage ac and dc test is performed in accordance with Part 6.27 of ICEA S-68-516 at the ac and dc test voltages given in Table II.
- D. Shield resistance is measured and recorded from end to end on the completed cable.
- E. Corona Test: Each reel of completed shield power cable shall comply with the maximum partial discharge in picocoulombs specified in Table IV.

TABLE IV

|                                     |   |      |      |      |      |
|-------------------------------------|---|------|------|------|------|
| VT/vg ratio                         | 1.0   | 1.5  | 2.5  | 3.0  | 4.0  |
| AEIC CS-6<br>Reqmts<br>(PacifiCorp) | 5   | 5    | 5    | 5    | 10   |
| Cable Voltage<br>Rating in kV       | Test Voltages (Vt) in kV Corresponding to Vt/Vg Ratio |      |      |      |      |
| 15                                  | 8.5   | 13.0 | 21.5 | 26.0 | 35.0 |

\*The ac test voltages shown in Table II shall not be exceeded.

The partial discharges test shall be performed in accordance with the procedures of Section F of AEIC CS-6 and a X-Y recording graph will be furnished showing the corona test results.

## 2.9 QUALITY ASSURANCE

- A. The Cable shall be manufactured and tested under the control of a Quality Assurance program which meets the requirements of Section 10CFR50, Appendix B, of the Federal Register as defined in ANSI N45.2.

- B. The Quality Assurance program shall demonstrate compliance with the above referenced criteria by having passed yearly Quality Audits conducted by outside independent organizations.

### PART 3 - MANUFACTURERS

#### 3.1 ACCEPTABLE MANUFACTURERS

1. Okonite
2. BICC
3. Perielli
4. Kerite

END SECTION 16125

## SECTION 16126 - POWER CABLE INSTALLATION METHODS

### PART 1 - EXECUTION

#### 1.1 GENERAL

- A. Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.
- B. Primary cables shall not be pulled into concrete encased plastic conduit until all conduit joints made using plastic conduit cement have been allowed to dry for at least ½ hour.
- C. When pulling cables into conduit, the pulling line used shall have a safe working load rating (minimum) equal to the maximum allowable pulling line tensions for the type and size of cables being pulled as recommended by the manufacturer. Cables shall be pulled into conduit with a pulling eye attached to the cable conductor or a pulling grip placed over the cable sheath, insulation or jacket.
- D. When primary cables are pulled into straight conduit runs, the pulling line tension shall not exceed the values shown in the manufacturer's shop drawings.
- E. When primary cables are pulled into conduit runs including bends or sweeps, the maximum pulling line tension shall not exceed 300 times the radius of curvature of the bend or sweep with the smallest radius expressed in feet.

#### 1.2 CABLES PULLING IN CONDUIT

- A. Whenever possible, pull cables so that bends in the conduit into which the cables are to be pulled are nearest to the feed-in end. This will result in minimum tension on the cables.
- B. On long pulls, the pull-out manhole should be rigged whenever possible, so that an adequate amount of cable for splicing and racking may be pulled into the manhole without the necessity of taking hitches on the cable sheath or jacket.
- C. In highly congested manholes or where cables must be bent sharply to permit pulling, use a feed-in tube for pulling in cables. This will reduce pulling tensions and prevent damage to the cables being pulled and to other adjacent cables.
- D. Before making a pull, conduits should be clear and free of dirt, rocks, etc.
- E. When pulling three or four single conductor cables in one conduit, consideration should be given to the possibility of the cables jamming, particularly at bends. This possibility occurs when the sum of the outside diameters of the three cables approximately equals the inside diameter of the conduit they are to be pulled into. When the possibility of jamming exists, pulling tension should be continuously monitored to ensure that damage to the cables, should they jam, will be kept to a minimum.
- F. Wire rope shall not be used to pull cables in nonmetallic conduits unless all bends in the conduits are constructed using a bent length of steel conduit or steel conduit elbows.
- G. Do not pull cable into duct or conduit until factory test reports of cable have been approved.
- H. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them

together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

- I. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
- J. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.
- K. For training of cables, minimum bend radius to inner surface of cable shall be 15 times cable diameter.
- L. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.
- M. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and which is listed by UL.
- N. Seal all cable ends unless splicing is to be done immediately.
- O. Train and support all cables in manholes, pullholes, concrete trenches, and similar locations by porcelain cable clamps. Place each cable on separate cable clamp.
- P. All cables shall have heat shrinkable caps (Raychem) installed until the cables are to be terminated. Caps shall prevent all water and moisture from entering the cables.
- Q. Where trunk high voltage cables (as opposed to branch feeders cables to buildings) are pulled into manholes, the cable shall ring the manhole before terminating on the oil switch or other terminating equipment.

### 1.3 AFTER INSTALLATION TESTING

- A. After installation and before the operating test on connection to the existing system, the cable shall be given a high potential test.
- B. Test all cable per ICEA Standards and in accordance with IEEE Standard 400-1991. Notify Owner's representative of proposed date of test sufficiently in advance so that arrangements can be made for the Engineer and Draper Prison Site Utilities personnel to witness the test.
- C. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds and metallic shieldings or sheaths of the cable as the other terminal for each test.
- D. For all new cable installation, perform test after all splices, terminations and connections are complete, except at point where cable under this contract is to be connected to existing system. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment.
- E. Test the conductor for continuity with all equipment disconnected.
- F. The method, voltage, length of time, shall be as specified and other characteristics of the test shall be in accordance with NEMA WC7 or WC8 for the particular type of cable installed, and shall not exceed the recommendations of IEEE Std. 48, 1990, for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing.

- G. High potential DC test for the new cable and equipment shall start at zero volts and increased in 5,000 volt increments until a maximum value of 35,000V is reached, for 15 kV systems. However, test voltage level shall not exceed manufacturers recommended test voltage for any cable, splices, or equipment connected to the system under test.
- H. The voltage step value as shown above shall be for a period of five minutes or until the leakage current has stabilized, whichever is less. If the leakage current does not stabilize, the test shall be stopped and the cable re-tested, if the second test does not stabilize, the cable test shall be discontinued.
- I. The leakage current shall be considered to be stabilized if the leakage current does not change more than five microamps in a 15 second period.
- J. Use DC tester specifically designed for the purpose, with overload or current-limiting devices to limit short circuit current. Record leakage current values at 1 minute intervals during the test. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed and perform a retest for acceptance.
- K. Submit three (3) copies of test, properly labeled, to the Engineer of review. Include all necessary test information such as cable system identification, ambient temperature, weather conditions, current, voltage, cable length, size, etc.

#### 1.4 CABLE PHASING

- A. Each cable shall be properly "phased" to assure proper connection to the system.
- B. Supply all equipment needed to make phasing checks.
- C. Notify the Engineer and Draper Prison personnel sufficiently in advance of making phase checks to allow for arrangements to be made for the witnessing of the tests.
- D. Make necessary changes to cable connection points, as determined by phasing checks, and reverify phasing after any cable changes.

END SECTION 16126

## SECTION 16127 – CABLE MARKING AND LOCATION

### PART 1 - SCOPE

- 1.1 This specification details the standard method to be used for marking primary and secondary underground cables to indicate the general direction from which each cable extends from a given site.

It also details a method for identifying individual phases in multi-cable primary and secondary cable systems.

### PART 2 - DEFINITIONS

#### 2.1 PRIMARY CABLES

- A. All cables with voltage ratings greater than 600 volts.

#### 2.2 SECONDARY CABLES

- A. All cables with voltage ratings of 600 volts or less.

### PART 3 - INSTALLATION

#### 3.1 DIRECTION IDENTIFICATION

- A. Primary and secondary cables shall be marked with tags with unique ID labels using equipment ID's as indicated in the drawings (i.e., vaults, primary junction boxes, service holes, manholes, secondary junction boxes, transformers, or splice boxes). This tag shall indicate the phase of the cable(s) and the ID of the next facilities where the cable is connected. All tags used must be approved by the Engineer.

1. All tags will be labeled with next point of connection. See attached instruction drawings.
2. All equipment will be numbered as per the instruction drawings prior to tagging the cable in order to be accurate. The tagging will be approved and inspected by the Engineer, and Draper Prison Site Utilities personnel.

#### B. PHASE IDENTIFICATION (PRIMARY)

1. In addition to the cable tags, individual phases in a primary or secondary multi-cable installation are to be identified, bands of white tape shall be used. Each phase shall be identified as follows: one band of white for "A" Phase, two bands of white for "B" Phase, and three bands of white for "C" Phase. Where multiple bands are used, separate bands by one tape width.

#### C. TAPE INSTALLATION REQUIREMENTS

##### 1. Width and Thickness

- (a) Tape used for phase identification shall be at least three layers of tape thick and should be limited in width to one width of tape.

##### 2. Placement of Tapes on Cables

- (a) The tape used for phase identification shall be placed at a convenient and easily visible spot near the point of entrance and exit of cables from a given site. Care shall be taken



when tape is placed on primary cables to ensure that the tape is placed over the conductor jacket.

#### D. CABLE IDENTIFICATION

1. Cable tagging will provide a means of identifying underground cables throughout their length. Specifically, this requirement includes the following:
  - (a) Cable phases should be tagged on all transformer equipment, cable switching stations, vault, and J-box locations.
  - (b) Care should be taken during the installation of the underground tagging system so that the cable phase identification integrity is maintained.
  - (c) The correct phase tag number should be placed on the cable whenever the cable is accessible such as in enclosures or splice boxes.
  - (d) Phasing should be indicated on the construction sketch so that this information can be placed on the permanent maps. This will include, but not be limited to:
    - 1) Phase identification of cables serving individual transformers.
    - 2) Phase identification of cables at all junction points.
  - (e) Cable tags must be changed whenever the cable system is changed.

#### E. SAFETY

1. **Do not shortcut or forget safe working procedures. Regardless of the accuracy of cable labeling, it cannot be relied upon when working and handling cables. The energized status of any individual cable must be tested by acceptable methods. Proper cable grounding procedures must be followed.**

F. Please refer to the following sketches for cable and phase identification examples.

END SECTION 16127

## SECTION 16130 - TERMINATIONS, SPLICES, AND ELBOW SURGE ARRESTERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Conditions apply to this section.
- B. Section 16125 - Single Conductor Shielded Power Cable Rated 15 kV, Type MV-105.
- C. Section 16126 - Power Cable Installation Methods

#### 1.2 SUMMARY

- A. This Section includes terminations and splices for High Voltage cables, types of terminations and splices in this section include the following:
  - 1. Terminations
  - 2. Elbow Terminations.
    - (a) 200A Loadbreak
  - 3. Elbow surge arresters

#### 1.3 APPLICABLE STANDARDS

- A. IEEE 48-1990, Test procedures and the requirements for High-Voltage Cable Terminations.
- B. IEEE 404-1986, Standard for Cable Joints for use with Extruded Dielectric Cable Rated 5000 through 46,000 volts, and Cable Joints for use with laminated dielectric cable rated 2500 through 500,000 volts.
- C. AEIC-CS5
- D. AEIC-CS6
- E. AEIC-1-68
- F. ANSI/IEEE 386-1985

#### 1.4 SUBMITTALS

- A. Product data for each type of termination and splice specified, to be used on the project.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Terminations and splices shall be suitable for outdoor and vault installations.

#### 2.2 TERMINATIONS

- A. Termination kits shall be capable of properly terminating a 15 kV class single conductor polymeric-insulated cable.

- B. Sizes shall be for the cable sizes indicated on the drawings and as specified in Section 16125 of this specification.
- C. Kits shall meet Class 1 requirements and be design-proof tested per IEEE 48-1975 and be capable of passing a test sequence per draft and revisions of IEEE 404-1986. Class 2 or 3 terminations are not acceptable.
- D. Kits as specified shall accommodate any common form of cable shielding/construction without the need for special adapters or accessories, and shall accommodate a wide range of cable size and, also, be capable of being properly installed on out-of-round or out-of-tolerance cable as per relevant ICEA standards. Kits shall accommodate commercially available connectors.
- E. Terminations for single-conductor cable shall consist of heat-shrinkable stress control and outer non-tracking insulation tubings along with a high relative permittivity stress relief mastic for insulation shield cutback treatment with a heat activated sealant for environmental sealing.
- F. The manufacturer shall have fifteen (15) years of actual field experience and suitable accelerated and real-time testing of weathering resistance.
- G. Electrical Specifications
 

|   |                         |
|---|-------------------------|
| 1. Voltage class, kV                                | 15                      |
| 2. AC withstand, 1 minute, kV                       | 50                      |
| 3. DC withstand, 15 min, kV                         | 75                      |
| 4. DEV, min kV for 3pC or less                      | 13.0                    |
| 5. Impulse withstand 1.2 x 50 microsecond, crest kV | 110                     |
| 6. Continuous current rating                        | Equal to cable ampacity |
| 7. Nominal overall length, in.                      | 15.5                    |
| 8. Wet withstand, 10 seconds, kV rms                | 45                      |
| 9. Dry withstand, 6 hours, kV rms                   | 35                      |

## 2.3 ELBOW TERMINATIONS

- A. Electrical Specifications
  - 1. 200 AMP loadbreak premolded 15 kV elbow connectors. Voltage rating shall be 8.3 kV phase to ground/ 14.4 kV phase to phase
    - (a) Impulse (BIL) 95 kV, 1.2 x 50 microsecond Wave
    - (b) AC withstand 34 kV, 60 HZ, 1 minute
    - (c) Corona Extinction Level 11 kV
  - 2. All premolded rubber products shall be in accordance with ANSI/IEEE 386-1985
    - (a) All rubber molded products shall be 100% factory tested
    - (b) All rubber molded products shall be 100% peroxide cured, both insulation and semi conductive.
    - (c) All mating products shall be produced by the same manufacturer to insure compatibility.
  - 3. All elbows shall be installed with proper shield adapting device.
    - (a) 200 AMP elbows shall be equipped with test points
  - 4. 200 A Loadbreak Elbow & Inserts
    - (a) 200 AMP Loadbreak elbows shall be capable of ten loadmake/loadbreak operations at 200 AMPS.
      - (1) Continuous current 200A, short time (.17 sec.) 10,000A

(2) ARC Followers shall have bellville washers to insure stable current transfer through the elbow connector.

(b) 200 AMP loadbreak inserts shall have the same ratings as the loadbreak elbows.

(1) Loadbreak inserts shall have an all copper current path

(2) Loadbreak inserts shall have an internal torquing method to insure proper assembly.

(3) Loadbreak inserts shall have a restrained piston assembly.

## 2.4 ELBOW SURGE ARRESTERS

A. Provide elbow type M.O.V. (Metal Oxide Varister) surge arresters at locations indicated on the drawings.

B. Elbow arresters shall be fully compatible with the standard 200A loadbreak bushing interface system.

C. Arresters shall be grounded as detailed on the drawings and as required by the arrester manufacturer.

D. The arrester shall be capable of installation on either energized or de-energized systems.

E. The arrester shall comply with all of the requirements of ANSI/IEEE standard C62.11 (latest revision) and applicable portions of ANSI/IEEE Standard 386 (latest revision).

F. Electrical Specifications

1. Fully compatible with 15 kV 200A loadbreak connector system.

2. High current short duration

(a) 2 discharges of 40kA crest.

3. Low current long duration

(a) 20 surges of 75 amperes/2000 microsecond duration.

4. Duty System Test

(a) 22 operations of 5 kA crests/8x20 microsecond duration while energized at rated voltage for the first 20 operations and MCOV for the final two operations.

5. Arrester shall have 95 kV BIL.

6. System voltage will be 13.2Y/7.62 kV.

7. Arrester shall be rated 10 kV with a MCOV of 8.4 kV.

G. Arresters shall be subject to production test to assure proper performance. Tests shall include but are not limited to:

1. Corona extinction voltage (100%)

2. Dielectric strength (100%)

3. Fluoroscope examination (100%)

4. Protective level of MOV blocks (100%)

5. Long term stability (partial sampling)

6. Energy absorption (partial sampling)

7. Residual voltage ratio (partial sampling)

H. Surge arresters shall be fully shielded and fully submersible.

### PART 3 - EXECUTION

- 3.1 All materials for high voltage terminations and splices shall be provided by the Contractor. The Contractor shall not substitute materials or tapes without written approval of the cable and splice kit manufacturer.
- 3.2 Contractor will install all high voltage terminations and splices. The Contractor shall perform all racking and grounding of all cables and terminations.
- 3.3 Terminations and splices shall be compatible with the type and size of cable that they will be installed on.
- 3.4 Finished installations shall have basic impulse levels as required for the system voltage level.
- 3.5 Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint.
- 3.6 Contractor is responsible to supply all material for terminations and connections made to both existing and new equipment. Termination and connections must be suitable for the application and as noted in the drawings.

END OF SECTION 16130

## SECTION 16150 - GROUNDING

### PART 1 - SCOPE

#### 1.1 WORK INCLUDED

- A. This section covers the work related to the complete installation of the distribution grounding system. Grounding shall include a complete system for all switches, transformer installations, manholes, and other appropriate equipment.

### PART 2 - MATERIALS

#### 2.1 GENERAL

- A. The Contractor shall furnish all ground materials also all other incidental items not specifically listed on the drawings, but required to make the grounding system complete. The Contractor shall provide all labor, tools, and equipment necessary for installation of the grounding system as shown on the drawings and specified herein.

#### 2.2 GROUND RODS

- A. 5/8" by 10 foot copper clad steel ground rod.

#### 2.3 GROUND CONDUCTORS

- A. Copper, #1/0 minimum, or as noted in the drawings.

#### 2.4 GROUND CONNECTIONS

- A. Provide compression connectors (Amp "Wrench Lock" or equal) as required. Must meet IEEE Standard 837-1984.

### PART 3 - WORKMANSHIP

#### 3.1 GENERAL

- A. Except where specifically indicated otherwise, ground all exposed non-current-carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in strict accordance with the NEC, state, and other applicable laws and regulations.
- B. Grounding conductors shall be straight and free from kinks, breaks, and other damage after installation. Conductors shall be thoroughly cleaned prior to making connections.
- C. All intersections of ground cables shall be connected together. All taps and ground rods shall be connected with separate connectors.
- D. All junctions and splices shall be made at ground rods wherever reasonably possible.
- E. All equipment and all steel structures shall be connected to the ground system. This also includes all panels, junction boxes, and auxiliary equipment.
- F. Each major equipment item shall have at least two ground connections.
- G. All metal structures shall be bonded to the ground loop or grounding conductor of a given location.

- H. Connections of conductor to the equipment shall be made with two-hole bolt-on bar lugs, unless otherwise specified, and connected in accordance with the manufacturer's recommendations.

### 3.2 NEUTRAL GROUNDING

- A. Neutral conductors shall be grounded at each equipment location and where indicated. Ground wires shall be not less than No. 1/0 AWG, except that where the rated phase current exceeds 400 amperes, the size of neutral ground wires shall be increased to not less than one-half the size of the cross-sectional area of the individual phase conductors. Where concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground wire and the opening shall be sealed with a suitable compound after installation of the ground wire. Bends greater than 45 degrees in ground wire connections to the ground rods or counterpoises are not permitted.

### 3.3 EQUIPMENT GROUNDING

- A. Equipment frames of metal-enclosed equipment, medium-voltage cable shields at cable terminations, and other non-current-carrying metal items, shall be grounded unless otherwise indicated. Connections to earth shall be made in the same manner as required for neutral grounding. Equipment or devices operating at less than 750 volts may be connected to secondary neutral grounds. Equipment operating at more than 750 volts to ground shall be provided with grounds separate from secondary neutral grounds, but both grounds shall be bonded together below grade at the ground rods or may utilize a common counterpoise. It should be noted that RGC secondary service conduits (where RGC is used for the full length of the conduit run(s)) are to be grounded at the service entrance end only and not at the transformer.

### 3.4 GROUND RODS

- A. At each equipment location and as indicated in the drawings, a 5/8-inch by 10-foot copper-clad steel ground rod(s) (as indicated) shall be driven into the earth. Where applicable, ground rods shall be installed through the PVC sleeves approximately 4 inches (6 inches max) of the ground rod will extend above the concrete surface.

### 3.5 GENERAL REQUIREMENTS

- A. A resistance of not greater than 25 ohms shall be provided, unless otherwise specified.

### 3.6 OPERATING TEST

- A. After the installation is completed, the Contractor shall conduct an operating test for approval. Equipment shall be demonstrated to operate in accordance with the requirements herein. Tests shall be performed in the presence of the Engineer and Owner's Representative. The Contractor shall furnish instruments and personnel required for the test.

### 3.7 GROUND-RESISTANCE MEASUREMENTS

- A. Ground-resistance measurements of each ground rod shall be taken and certified by the Contractor to the Engineer. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods and grounding system and submission of test results to the Engineer. Test reports shall indicate the location of the ground rod and grounding system and the resistance and the soil conditions at the time the test was performed. When the building water service is used as a ground or part of the grounding system, ground-resistance measurements shall also be made of this connection. Ground-resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds. The resistance to ground shall be measured using the fall-of-potential method described in IEEE No. 142. If the resistance proves inadequate, then additional

ground rods will be installed until an acceptable resistance level is achieved, up to a maximum of 4 ground rods for a given manhole, transformer enclosure or piece of equipment.

- B. Errors in the installation of the ground system shall be corrected by the Contractor at no expense to the Owner as directed by the Engineer.

### 3.8 EXECUTION

- A. Install a continuous copper ground conductor at each equipment location. Install ground rods as indicated, and connect to the ground conductor with #1/0 minimum bare copper conductor for major equipment as indicated in the drawings.
- B. Bond all metal structures (devices, equipment housings, etc.) to the ground loop with #6 bare copper conductor.
- C. At each location where the neutral is exposed, bond the neutral conductor to the ground equipment grounding system.

(NOTE: The equipment ground conductors shall not be used as part of the cable neutrals.)

- D. The grounding at each location shall meet all current applicable codes. This applies to both existing and new locations.

END SECTION 16150



## SECTION 16155 - 15 kV PADMOUNT CABLE SWITCHING STATION

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. This specification covers the features required for padmount metal cable sectionalizing enclosures used to house 15 kV, 200 ampere loadbreak junctions.
- B. The enclosures shall be provided as a completely assembled unit. 200A loadbreak junctions and associated pre-cast ground sleeve bases shall be provided as indicated in the drawings. Junctions shall be installed in the enclosure prior to shipment.
- C. The switching station shall be constructed for outdoor installation in areas subject to heavy precipitation, sprinkler irrigation, and in areas of windblown dust and contamination.

### PART 2 - ENCLOSURE CONSTRUCTION

- 2.1 These enclosures will be pad mounted and shall meet the latest revision of the ANSI C57.12.28 for Pad Mounted Equipment-Enclosure Integrity.
- 2.2 The enclosure shall be tamper resistant, all welded or bolted construction utilizing 14 gauge minimum sheet steel. Corner plates and braces shall be used as necessary to assure rigidity. The enclosure top shall be cross kinked to provide watershed and rigidity. The enclosure will be open bottom with 1" flange inside, all around the bottom of the enclosure.
- 2.3 The units of bolted design shall use external fasteners of 300 stainless steel. Bolts are to be of the carriage design to prevent removal from the exterior of the unit.
- 2.4 All doors shall be furnished with three (3) point locking, or a single continuous locking mechanism, utilizing a single Penta locking bolt and padlock. Locking bolt and pad lock hasp are to be located a minimum of 7 ½ " above the bottom of the unit.
- 2.5 Units shall have a minimum of two (2) lifting provisions, located such that the unit will be balanced when lifted, having adequate strength to lift the units utilizing normal lifting methods.
- 2.6 Hinges are to be 300 series stainless steel of the continuous hinge type with staked pin.
- 2.7 A permanent nameplate shall be provided on the inside of the unit and shall give a minimum of the following:
  - A. Manufacturer's name and location (City and State).
  - B. Catalog number.
  - C. Date of manufacture (day and year).
- 2.8 The switching station shall be given a durable, corrosion resistant, nonchalking, green outdoor finish capable of meeting or exceeding EEI finishing requirements.
- 2.9 Wind Gust Locks are to be provided as required to prevent closing of the units with the locks in place during winds of 70 MPH.
- 2.10 Panels to hold the junctions and parking bushings shall be independent from each other and shall be held in place with a locking bolt holding the panel in place by some other means than friction. The locking bolt is to be captive in the panel.

- 2.11 A minimum of two (2) grounding nuts shall be provided in each enclosure. Ground nuts shall be three hundred (300) stainless steel and shall be located on the lower back wall of the enclosure spaced such as to facilitate installing a ground buss.
- 2.12 Ground nuts shall be provided on both the enclosure and mounting bars.
- 2.13 Mounting bars shall be provided for cable junctions and parking stands. Mounting bars shall be compatible with all of the approved junction manufacturers listed in this specification.
- 2.14 Mounting bars shall be tilted upward at an angle of 10° to 122° to allow for ease of elbow operation.
- 2.15 The enclosure height shall be 30". The enclosure depth shall be 18" minimum. Width should be determined as required by the configuration.
- 2.16 The Manufacturer shall be responsible for the performance of all inspections and tests to insure compliance with the requirements of the user's specifications as well as applicable American National Standards.

### PART 3 - CABLE LOADBREAK JUNCTIONS

- 3.1 The junctions to be provided shall be of the 200A loadbreak type. The number of ways for each junction shall be as scheduled.
- 3.2 The junctions shall comply with the requirements of ANSI/IEEE 386 - latest revision. All electrical components provided shall be electrically and mechanically compatible with similar products of other approved manufacturers.
- 3.3 VOLTAGE (Insulation)
  - A. System voltage - 15 kV class with maximum 8.3 kV phase to ground/14.4 kV phase to phase.
  - B. BIL - 95 kV impulse voltage, 1.2 x 50 microsecond wave.
  - C. AC Withstand - 34 kV, 60 Hz, 1 minute.
  - D. DC Withstand - 53 kV, 15 minutes.
  - E. Corona Extinction Voltage - 11 kV
- 3.4 CURRENT (Connection)
  - A. Continuous operation 200 amps, rms.
  - B. Short-time: 10,000 amps, rms, sym, (.17 sec.) 1.3 max. asym factor.
- 3.5 LOADMAKE/BREAK (Switching)
  - A. 1 phase and 3 phase circuits 8.3 kV line to ground, 14.4 kV max. Across the open contacts.
  - B. 10 loadmake/loadbreak OPERATIONS at 200 amps. max. With 70 to 80% lagging PF.
- 3.6 FAULT CLOSE (Switching)
  - A. 1 fault-close operation at 8.3 kV or 14.4 kV; 10,000 amps, rms, sym, 10 cycles (.17 sec.)
  - B. 1.3 max. asym factor applies to new or used mating parts (up to maximum designated switching operations).

- 3.7 Shield design shall meet the IEEE Standard 592-1977 for Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors.
- 3.8 Required Production tests are to include the following:
- A. Corona Extinction Voltage: 11 kV min. (tested at 3 pc. sensitivity).  
and either of the following dielectric strength tests:
  - B. Impulse (BIL) 95 kV, 1.2 x 50 microsecond wave.
  - C. AC Withstand 34 kV, 60 Hz, 1 minute.
- 3.9 100% of all products supplied shall be tested.
- 3.10 Two parking stands (one on each side) shall be provided on each cable junction.
- 3.11 Parking stands shall allow for the use of feed through bushings, parking bushings, and grounding bushings. Grounding provisions shall be provided to allow for proper grounding of devices which may be placed into the parking stands.
- 3.12 Approved junction manufacturers are:
- A. Cooper.
  - B. Elastimold.
  - C. Chardon.

#### PART 4 - ACCESSORY EQUIPMENT

- 4.1 A fiberglass one-piece base for the support of the gear shall be used. The base shall provide 24" of additional cable termination space and provide support for the gear. Four hold down clamps are required for each base. The base color shall match the cable switching station color.
- 4.2 Hazard-Alerting Signs
- A. The exterior of the padmounted enclosure shall be provided with "Warning - Keep Out - Hazardous Voltage Inside - Can Shock, Burn or Cause Death" signs.
  - B. Each enclosure shall be provided with a "Danger - Hazardous Voltage - Failure to Follow These Instructions Will Likely Cause Shock, Burns or Death" sign. The text shall further indicate that operating personnel must know and obey the employer's work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment.
  - C. Each enclosure shall be provided with a "Danger - Keep Away - Hazardous Voltage - Will Shock, Burn or Cause Death" sign.

#### PART 5 - SHIPPING AND HANDLING.

- 5.1 Units are to be shipped on individual pallets for convenient forklift handling, secured and packaged to prevent damage during shipment. Each pallet shall be marked with the manufacturer's name or symbol, catalog number, and name of item. A packing slip shall be included with each shipment.
- 5.2 If units are not packaged to be double stacked, the Bill of Lading is to be marked "SPECIAL INSTRUCTIONS TO MATERIAL HANDLER: DO NOT DOUBLE STACK."

## PART 6 - APPROVED MANUFACTURERS

6.1 The following are approved manufacturers of the cable switching station enclosures:

- A. Cooper.
- B. Malton.
- C. Maysteel.
- D. Durham.
- E. Shallbetter.
- F. Elliott.

END OF SECTION 16155

## SECTION 16159 - EXISTING EQUIPMENT DISPOSAL

### PART 1 - GENERAL

- 1.1 This specification identifies the work and method for the disposal of the existing electrical equipment.
- 1.2 The existing transformers have been PCB tested and are non-PCB.

### PART 2 - EQUIPMENT DISPOSAL

- 2.1 Unless otherwise indicated, all of the existing electrical equipment that will be removed under the project is to be disposed of by the Contractor.
- 2.2 The Contractor's bid price is to include the costs for disposal of the various pieces of equipment at this location.

### PART 3 - EQUIPMENT TO BE DISPOSED

- 3.1 Equipment to be disposed of shall include, but is not limited to, transformers, etc.
- 3.2 The contractor will be required to dispose of the unusable cable equipment and materials as well as construction debris and garbage. The storage areas are not be used as a "junk yard."

END OF SECTION 16159

## SECTION 16215 - SECONDARY LINE INSTALLATION

### PART 1 - SCOPE

- 1.1 This standard outlines minimum requirements for the service equipment, service conductors, etc.

### PART 2 - APPLICATION

#### 2.1 GENERAL

- A. This standard shall be used as a guideline for determining whether or not the service equipment, service conductors, etc. that comprise the secondary service meet all applicable national, state and local codes and ordinances and Owner's requirements.
- B. Also see Section 16220 for service entrance equipment requirements.

#### 2.2 SERVICE CONNECTION CRITERIA

- A. Services inspected by the Owner.
  - 1. Underground services shall not be connected to the electrical system until:
    - (a) The Owner's Inspector has certified that the service is in compliance with applicable local, state and national codes and policies.

### PART 3 - DEFINITIONS

#### 3.1 SERVICE EQUIPMENT

- A. The equipment, containing the disconnecting means and overcurrent protective devices, located near the point of entrance of supply conductors to a building, and intended to constitute the main control and means of cutoff of the supply to a building.

#### 3.2 UNDERGROUND SERVICE CONDUCTORS

- A. The underground supply conductors that extend from the transformer or secondary junction box to the building's service and metering equipment.

#### 3.3 GROUNDING ELECTRODE

- A. A 5/8" X 10' nonferrous copper clad ground rod shall be used as the grounding electrode. When a metal underground water pipe system is available on the premises, the water pipe system and the ground rod shall be used as grounding electrodes (refer to the NEC for additional requirements).

#### 3.4 GROUNDING ELECTRODE CONDUCTORS

- A. The conductors used to connect the grounding electrode(s) to the grounded conductor of the underground service.

#### 3.5 BURIAL DEPTH

- A. Where underground Service Conductors are installed in conduits with supplemental protective covering or in raceways, the vertical distance from the surface under which the conduit,

supplemental protective covering, or raceway, is installed 30" minimum to the portion of the conduit, supplemental protective covering or raceway nearest the surface.

### 3.6 SERVICE RISER

- A. Steel conduit, conduit elbow, etc. that extend from the bottom of the service trench to the meter mounting provisions and main disconnecting means and enclose the service conductors.

### 3.7 SERVICE CONDUIT

- A. Plastic or steel conduit into which underground service conductors are pulled, excluding service risers.

## PART 4 - CODES

### 4.1 INSTALLATION

- A. Underground services shall be installed in accordance with the drawings and applicable requirements of local, state and national codes and ordinances.

### 4.2 EQUIPMENT AND CONDUCTORS

- A. All equipment and conductors installed shall meet or exceed applicable requirements of local, state and national codes and ordinances.

## PART 5 - INSTALLATION

### 5.1 UNDERGROUND SERVICE CONDUCTORS

#### A. Burial Depths

- 1. The minimum burial depth underground service conduits shall be 30 inches.

#### B. Type

- 1. All underground service conductors shall be type USE or XHHW-2 unless noted otherwise.

#### C. Protection

- 1. Underground service conductors are to be protected from physical damage, by installation in conduit (PVC Schedule 40 or better).

#### D. Splices

- 1. Underground service conductors shall not be spliced.

#### E. Installation Methods

##### 1. In conduit

- (a) When underground service conductors are pulled in conduit, care shall be taken to ensure that they are not damaged during the pulling operation.

#### F. Grounding Requirements

1. A grounding electrode shall be connected, via grounding electrode conductors, to the underground service conductors (grounded conductors only) on the line side of and/or within the service disconnecting means.

#### G. Size

1. The underground service conductors shall have adequate ampacity to carry the load requirements of the premises served by the conductors. Service conductor sizes shall comply with drawing requirements.

### 5.2 SERVICE EQUIPMENT

#### A. Continuous Current Rating

1. All service equipment shall have a minimum current rating as indicated.

#### B. Short Circuit Current Rating

1. Service equipment and its overcurrent protective devices shall have short circuit current ratings greater than or equal to the short circuit current available at their supply terminals.

### 5.3 SERVICE DISCONNECTING MEANS

- A. All service disconnecting means shall have a current rating of not less than 60 amperes, as scheduled.

- B. When multiple switches or circuit breakers are used as the disconnecting means, their combined current rating shall not be less than 60 amperes.

### 5.4 SERVICE CONDUIT

#### A. General

1. Service conduit installations shall be carefully designed (length, number of bends, bend radii, etc.) to ensure that the underground service conductors can be pulled into them without damage.

#### B. Burial Depth

1. Minimum burial depths for service conduits shall be 30 inches.

#### C. Trench Requirements

##### 1. Trench Bottoms

- (a) When conduits are direct buried or concrete encased, the bottom of the trench into which the conduits are placed shall be free from rocks exceeding 1 inch in their largest dimension. When the trench bottom contains rocks exceeding this size requirement, the trench shall be excavated 6 inches deeper than the burial depth required for the conduits and then backfilled to the required burial depth with sand or screened backfill.



2. Trench Backfill

(a) Direct Buried Plastic Conduit

- (1) At least 6 inches of 1-inch minus backfill shall be placed over the conduits. The remaining backfill shall be spoil removed from the trench unless specific backfill requirements exist.

END OF SECTION 16215

## SECTION 16220 - SERVICE ENTRANCE EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.
- B. Basic Electrical Materials and Methods sections apply to work specified in this section.

#### 1.2 SUMMARY:

- A. Extent of service-entrance work is indicated by drawings and schedules.
- B. Types of service-entrance equipment in this section include the following:
  - 1. Service Entrance Panelboard Meter.
- C. Wires/cables, raceways, and electrical boxes and fittings are specified in Division-16 Basic Electrical Materials and Methods sections, "Wires and Cables", "Raceways", and "Electrical Boxes and Fittings."
- D. Refer to other Division-16 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with service-entrance equipment.

#### 1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on service-entrance equipment and accessories.
- B. Shop Drawings: Submit dimensioned layouts of service-entrance equipment, including spatial relationships to proximate electrical equipment.
- C. Wiring Diagrams: Submit power, signal and control wiring diagrams for service-entrance work. Differentiate between portions of wiring/cabling that are manufacturer-installed and portions that are field-installed.

#### 1.4 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of service-entrance equipment, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 5 years of successful installation experience with projects utilizing service-entrance work similar to that required for this project.
- C. Codes and Standards:
  - 1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including Articles 230, 250, and 338, as applicable to installation, and construction of service-entrances.
  - 2. NEMA Compliance: Comply with applicable construction and installation requirements and NEMA standards for service-entrance equipment and accessories.
  - 3. UL Compliance: Comply with construction and installation requirements of the following UL standards for service-entrance equipment and accessories:
    - (a) UL 854: Service-Entrance Cables.

(b) UL 869: Electrical Service Equipment.

4. Provide service-entrance equipment and accessories which are UL-listed and labeled, and marked, "SUITABLE FOR USE AS SERVICE EQUIPMENT."
5. IEEE Compliance: Comply with applicable requirements of IEEE Std 241 pertaining to service entrances.
6. ANSI Compliance: Comply with ANSI C2, "National Electrical Safety Code", installation requirements for aboveground service-entrance conductors.

#### 1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver service-entrance equipment components properly packaged and mounted on pallets, or skids to facilitate handling of heavy items. Utilize factory-fabricated type containers or wrappings for service-entrance equipment and components which protect equipment from damage. Install gravity measuring meters in containers which indicate whether container has been bumped or dropped. Return G-meters to manufacturer for reuse upon delivery of switchgear. Inspect equipment to ensure that no damage has occurred during shipment.
- B. Store service-entrance equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle service-entrance equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

#### 1.6 SEQUENCING AND SCHEDULING:

- A. Schedule delivery of service-entrance equipment which permits ready building ingress for large equipment components to their designated installation spaces. Coordinate delivery of equipment with the installation of other building components.
- B. Coordinate with other electrical work including raceways, electrical boxes and fittings, and cabling/wiring work, as necessary to interface installation of service-entrance work with other work.

### PART 2 - PRODUCTS

#### 2.1 SERVICE-ENTRANCE EQUIPMENT:

- A. General: Provide service-entrance equipment and accessories; of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified.
- B. Raceways:
  1. General: Provide raceways complying with Division-16 Basic Electrical Materials and Methods section "Raceways", in accordance with the following listing:
    - (a) Rigid Steel Conduit, and fittings.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION:

- A. Examine areas and conditions under which service-entrance equipment and components are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

### 3.2 INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT:

- A. Install service-entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.
- B. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

### 3.3 FIELD QUALITY CONTROL:

- A. Prior to energization of service-entrance equipment, check accessible connections for compliance to manufacturer's torque tightening specifications.
- B. Prior to energization of service-entrance equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- C. Prior to energization, check circuitry for electrical continuity, and for short-circuits.

### 3.4 GROUNDING:

- A. Provide equipment grounding connections for service-entrance equipment as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.
- B. A proper neutral-ground bond shall be established at each service entrance. Comply with all applicable code requirements.

### 3.5 ADJUSTING AND CLEANING:

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred enclosure surfaces to match original finishes.

### 3.6 DEMONSTRATION:

- A. Upon completion of installation of service-entrance equipment and electrical circuitry, energized circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION 16220

## SECTION 16235 - ELECTRICAL BOXES AND FITTINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to this Section.
- B. This is a Division-16 Basic Materials and Methods section and is part of each Division-16 Section referencing to electrical boxes and fittings specified in this section. See Raceway Section 16110 for additional requirements.

#### 1.2 SUMMARY

- A. This section includes boxes and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:
  - 1. Pull and junction boxes.
  - 2. Bushings, locknuts and knockout closures.
  - 3. Conduit bodies.

#### 1.3 SUBMITTALS - None required.

#### 1.4 QUALITY ASSURANCE

- A. Electrical boxes, fittings, etc. shall comply with current applicable NEMA, ANSI and NEC requirements pertaining to material, construction, sizing, installation, testing and performance. All products shall be UL listed and labeled.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide floor boxes by the following:
  - 1. Crouse Hinds Co.
  - 2. Hubbell, Inc.
  - 3. Square D
  - 4. Steel City

#### 2.2 CABINETS, BOXES, AND FITTINGS, GENERAL

- A. Electrical Boxes, and Fittings: Of required types, sizes, and NEMA enclosure classes. Provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

#### 2.3 MATERIALS AND FINISHES

- A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
- B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
- C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

- D. Cast Metal for Boxes, Enclosures, and Covers; Copper-free aluminum except as otherwise specified.
- E. Use non-metallic boxes for non-metallic sheathed cable and non metallic raceways.
- F. Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
- G. Fittings for Boxes and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

#### 2.4 PULL AND JUNCTION BOXES

- A. Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed on covers of material same as box and shall be of size, shape and NEMA rating to suit application. Boxes to be code-gage sheet steel with welded seams and stainless steel bolts, washers, screws and nuts.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
- B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- C. Support and fasten items securely in accordance with Division 16 Section "Supporting Devices."
- D. Sizes shall be adequate to meet NEC volume requirements or as indicated; whichever is more stringent per the application.
- E. Remove sharp edges where they may come in contact with wiring or personnel.
- F. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- G. Support boxes independently of conduit.
- H. Use gang box where more than one device is mounted together. Do not use sectional box.
- I. Do not install boxes or conduit bodies in inaccessible areas, behind ducts or equipment, etc.
- J. Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

#### 3.2 GROUNDING

- A. Electrically ground metallic boxes and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the box or enclosure.

END OF SECTION 16235

## SECTION 16275 - CIRCUIT DISCONNECTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to this Section.
- B. This is a Division 16 Basic Materials and Methods section and is part of each Division 16 section referencing to circuit disconnects specified in this section.

#### 1.2 SUMMARY

- A. The extent of circuit disconnects is indicated on drawings and includes complete installation and connections.

#### 1.3 SUBMITTALS

- A. Product data for each type of product specified.
- B. Maintenance data for circuit disconnects, for inclusion in Operation and Maintenance Manual specified in Section "Basic Electrical Requirements."

#### 1.4 QUALITY ASSURANCE

- A. All circuit disconnects shall comply with current, applicable NEC, NECA, NEMA (Standard KS1) and UL standards pertaining to materials, construction, sizing, installation and performance. Products shall be UL listed and labeled.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Challenger
  - 2. Crouse-Hinds Co.
  - 3. Cutler-Hammer Inc.
  - 4. General Electric Co.
  - 5. Square D Company.
  - 6. General Electric

#### 2.2 CIRCUIT DISCONNECT SWITCHES

- A. General: Provide heavy duty (208V, 480 or 240V, 60 Hertz) type (fusible or non-fusible as indicated) circuit and motor disconnect switches in types, sizes, duties, features, ratings and enclosures as required and as follows:
  - 1. NEMA 3R enclosures for exterior and/or damp/wet locations.
  - 2. Enclosures to be sheet steel in construction.
  - 3. Handle shall be capable of being padlocked in the "OFF" position.
  - 4. Capable of single or three phase operation (solid neutral as required).
  - 5. Spring assisted quick-make, quick-break operation.
  - 6. Class R rejection fuse dip kits for fusible switches.

7. CU rated lugs applicably sized to conductors.

- B. Fuses: Provide fuses as required in types, ratings and classes for the service indicated. Provide one spare set of fuses for each disconnect supplied.

## 2.3 ACCESSORIES

- A. Electrical Interlocks: Provide number and arrangement of interlock contacts in switches as indicated and/or required.
- B. Captive Fuse Pullers: Provide built-in fuse pullers arranged to facilitate fuse removal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF CIRCUIT DISCONNECTS

- A. General: Provide circuit disconnect switches as indicated and where required by Code. Comply with switch manufacturers' printed installation instructions.

### 3.2 FIELD QUALITY CONTROL

- A. Testing: Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 16275



## SECTION 16300 - THREE-PHASE PADMOUNTED DISTRIBUTION TRANSFORMER

### PART 1 - SCOPE

#### 1.1 GENERAL

- A. This specification outlines the electrical characteristics and the mechanical features of deadfront outdoor three-phase, 60 Hz, oil immersed, self-cooled pad-mounted, compartmental-type distribution transformers with separable insulated high voltage connectors.

#### 1.2 STANDARDS

- A. All transformers shall be constructed and tested in accordance with the latest revision of ANSI C57.12.26 and the applicable NEMA standards.
- B. No used or remanufactured material or components will be acceptable.

### PART 2 - RATINGS

#### 2.1 VOLTAGE AND KILOVOLT-AMPERE RATINGS

- A. The standard kVA ratings shall be one of the following:
  - 1. 75 kVA, 112.5 kVA, 150 kVA, 225 kVA, 300 kVA, 500 kVA, 750 kVA.
- B. These standard kVA ratings are continuous and based on not exceeding either a 65°C average winding temperature rise or an 80°C hot spot temperature rise. The temperature rise of the insulating oil shall not exceed 65°C when measured near the top of the tank.

#### 2.2 VOLTAGE

- A. The high voltage rating shall be 12,470Y/7200 volts. The low voltage rating shall be 208Y/120 V or 480Y/277V as scheduled.

#### 2.3 TAP RATINGS

- A. The transformers shall be equipped with: (2) 2-1/2 percent taps above and (2) 2-1/2 percent taps below normal voltage. All taps shall be full capacity taps.
- B. Tap changing to be through the wall in the high voltage connection compartment for external to tank adjustment.
- C. Taps shall have the positions of the changer clearly marked to indicate actual voltage on the primary, or as a % of above and below normal primary voltage.
- D. Taps shall be operable only with the transformer de-energized.

#### 2.4 BASIC IMPULSE INSULATION LEVEL

- A. The basic impulse insulation level (BIL) shall be 95 kV.

## PART 3 - CONSTRUCTION

### 3.1 GENERAL

- A. All transformers shall consist of a transformer tank and a high- and low-voltage cable termination compartment. These components shall be assembled as an integral, tamper proof and weatherproof unit for mounting on a pad. The transformer shall meet the requirements for tamper resistance as set forth by the Western Underground Committee. There shall be no exposed bolts, screws or other fastening devices which are externally removable. There shall be no openings through which foreign objects such as wires or rods might be inserted to contact live parts.

### 3.2 TANK

- A. Transformer tank shall be suitable for outdoor installation. The tank shall be of a construction that effectively seals the tank interior from the atmosphere but will allow entry for service.
- B. Construction of the seal shall maintain the integrity of the seal over an operating oil temperature range of -5°C to 105°C.
- C. Tank construction shall be such that it has sufficient strength to withstand a pressure of 7 psi gage without permanent distortion.

### 3.3 HIGH- AND LOW-VOLTAGE COMPARTMENTS

- A. The high- and low-voltage cable terminating compartment shall:
  - 1. Be compartmentalized into high-voltage and low-voltage segments by a suitable barrier.
  - 2. Include two doors, one for the high-voltage segment and one for the low-voltage segment. These doors shall have stainless steel hinges and pins and three-point latching with provisions for padlocking. Unlocking the padlock shall permit access to the low-voltage segment of the terminating compartment only. Access to the high-voltage segment of the terminating compartment shall not be attained until an additional fastening device has been released.
  - 3. Meet the dimensional requirements of Figure 7 of ANSI Publication C57.12.26 latest revision.
  - 4. The high-voltage compartment shall be equipped with accessory elbow parking stands for each elbow.

### 3.4 TERMINATION ARRANGEMENT AND DIMENSIONS

- A. The termination arrangements and dimensions of Figures 6, 7, and 8 of ANSI Publication C57.12.26 latest revision shall be applicable to this specification.

### 3.5 HIGH-VOLTAGE TERMINATIONS

- A. Configuration - The configuration of the high-voltage terminations shall be Radial Feed as scheduled (ANSI C57.12.26 latest revision).
- B. Type - The high-voltage terminations shall be 15 kV class bushing or wells and inserts suitable for use with 15 kV class loadbreak elbow connectors respectively. The continuous current rating shall be 200 A.

NOTE: All loadbreak bushing inserts shall be provided with the transformer.

### 3.6 LOW-VOLTAGE TERMINATIONS

- A. Terminals - The terminal of all low-voltage terminations shall be as shown in Figure 9A, 9B, or 9C of ANSI Publication C57.12.26 latest revision.

- B. Configuration - The configuration of the low-voltage terminations shall be as shown in Figure 8A of ANSI Publication C57.12.26 latest revision.
- C. Secondary low-voltage bushings shall include a full capacity neutral (grounded conductor) bushing.
- D. The electrical characteristics of the completely assembled low-voltage bushing and termination shall be:
  - 1. Insulation Class: 1.2 kV
  - 2. BIL: 30 kV
  - 3. One Minute Withstand: 10 kV
- E. Internal connections to the secondary bushings shall be by lugs welded to the secondary conductor and bolted to the bushing stud.

### 3.7 FUSING EQUIPMENT

- A. All transformers shall be equipped with externally removable, oil immersed, expulsion fuses, in a loadbreak bayonet suitable for hot stick operation. This fuse shall be in series with an under oil partial range current limiting fuse. The fuses shall be coordinated to ensure that the current limiting fuse will only operate on faults internal to the transformer. The current limiting fuse used shall have an interrupting rating of 50,000 amperes (minimum) symmetrical.

### 3.8 CORE AND WINDINGS

- A. All wye-wye connected transformers shall have four- or five-legged core construction or shall otherwise include provisions to prevent excessive tank heating. The core construction or other provisions for preventing tank heating shall be adequate for unbalanced loading conditions of one or more of the primary phases of the transformer being energized from the same (single-phase) source.
- B. One piece core construction is desired. Where other construction is used, minimum assembly joints shall be provided. For approved two part cores, the core shall be held together with bands and torqued bolts. Crimped banding is not acceptable.
- C. Copper winding conductors are required for both high voltage and low voltage windings.
- D. Core material may be either silicon steel or amorphous.
- E. Core losses shall be minimized by the core material and core construction.
- F. Transformers shall be equipped with a common HoXo bushing with a copper grounding strap to the transformer case.

### 3.9 INSULATION

- A. All insulating paper used as layer insulation in transformer coils shall be coated on both sides with a thermosetting adhesive and properly cured prior to impregnating with oil, or the coils shall be wound with primary conductor containing a thermosetting adhesive that when properly cured will form an effective bond.
- B. Insulating/cooling fluid within the tank shall be electrical grade mineral oil or a non-flammable environmentally accepted fluid.
- C. All fluids shall be certified and indicated on the name plate to be less than 1 part/million PCB content.

- D. Fluids other than mineral oil shall have submitted with the quotation complete chemical and electrical characteristics and a statement of being non-PCB.

### 3.10 PRESSURE RELIEF DEVICE

- A. Each transformer shall be equipped with a self-actuating pressure relief device to relieve slow pressure buildup and to automatically vent when pressure reaches +/- 10 PSIG and recloses when pressure fails to +/- 6 PSI.

### 3.11 MOUNTING AND LIFTING

- A. Mounting shall be suitable for concrete pad mounting. Provide suitable anchorage brackets for seismic zone 3.
- B. The tank shall have lifting provisions of adequate strength, size and arrangement on the transformer to permit lifting the transformer in an upright position when filled with insulating fluid.

### 3.12 GROUNDING

- A. The tank shall have a welded ground lug boss attached on the secondary side of the tank near the bottom of the tank clear of secondary bushings and attached conductors. A ground lug shall also be provided in the primary side of the tank near the tank bottom.
- B. The grounding boss shall be free of paint and shall be 7/16 inch deep and threaded for a ½" 13 NC grounding stud or connector.
- C. The tank cover shall have a grounding strap between the cover and the tank.

### 3.13 ACCESSORIES

- A. ANSI C57 12.26 standard accessories shall be provided.

## PART 4 - FINISH

- 4.1 The transformer shall be given a durable, corrosion resistant, nonchalking, green outdoor finish capable of meeting or exceeding EEI finishing requirements.
- 4.2 All transformer surfaces in contact with the pad shall be designed or treated to minimize corrosion.
- 4.3 DANGER - HIGH VOLTAGE signs shall be provided on the outside of each transformer. A similar sign shall also be provided on the inside of each door(s).
- 4.4 The transformer kVA shall be indicated in permanent 3" high black letters on the outside of each transformer.

## PART 5 - SHIPPING AND IDENTIFICATION

### 5.1 SHIPPING

- 5.2 Transformers shall be shipped on pallets.

### 5.3 IDENTIFICATION

- A. The nameplate shall contain the manufacturers name, address, kVA, primary voltage, secondary voltage(s), % impedance, rated temperature rise, a wiring diagram indicating connections and voltages with polarity (additive or subtractive), core losses (no load and full load), insulating fluid identification, and PCB content, weight when full, manufacturers part (catalog) number, and serial number unique to the transformer.
- B. The nameplate shall conform to ANSI standard C57 12.00 and C57 12.26 latest revision.
- C. The nameplate shall be mounted on a permanently attached backing plate with welds or rivets. Removable nameplates or nameplates attached to removable parts will not be accepted.

### PART 6 - TESTING

- 6.1 All transformers shall be tested in accordance with the requirements of American National Standard Publication C57.12.26 latest revision. All transformers shall be capable of withstanding short circuit tests.

### PART 7 - LOSS REQUIREMENTS

- 7.1 Total watt losses shall not exceed the following:

| 3-Phase Padmount 120/208 Volt |                        |                  |                        |
|-------------------------------|------------------------|------------------|------------------------|
| <u>Rated kVA</u>              | <u>Losses in Watts</u> | <u>Rated kVA</u> | <u>Losses in Watts</u> |
| 75 kVA                        | 815 Watts              | 300 kVA          | 2380 Watts             |
| 112.5 kVA                     | 1125 Watts             | 500 kVA          | 4060 Watts             |
| 150 kVA                       | 1300 Watts             | 750 kVA          | 6500 Watts             |
| 225 kVA                       | 1950 Watts             |                  |                        |

| 3-Phase Padmount 277/480 Volt |                        |                  |                        |
|-------------------------------|------------------------|------------------|------------------------|
| <u>Rated kVA</u>              | <u>Losses in Watts</u> | <u>Rated kVA</u> | <u>Losses in Watts</u> |
| 150 kVA                       | 1385 Watts             | 750 kVA          | 4,500 Watts            |
| 225 kVA                       | 2000 Watts             | 1,000 kVA        | 6,500 Watts            |
| 300 kVA                       | 2460 Watts             | 1,500 kVA        | 10,500 Watts           |
| 500 kVA                       | 4325 Watts             |                  |                        |

- 7.2 All actual tested loss data will be transmitted to the Draper Prison and ICPE within five days after shipment of the transformers.

### PART 8 - VENDOR EVALUATION

- 8.1 Vendor evaluations as well as loss evaluations will be used to determine the low bidder. Delivery dates will be of prime concern during the bid evaluation.

### PART 9 - EXCEPTIONS

- 9.1 Exceptions to this Specification shall not be accepted, unless approved by the Engineer. Any exceptions taken shall be noted in the proposal.

## PART 10 - WARRANTY

- 10.1 Manufacturer shall warrant to Purchaser that the apparatus or services to be furnished hereunder shall be of the highest quality and free from defects in material, workmanship, and title and will be of the kind designated in the pertinent purchase order. The Manufacturer's warranty shall be effective for a period of twelve (12) months after the date of shipment to Purchaser. Terms of Manufacturer's warranty shall be included in the bid proposal and will be a criterion for evaluation of the proposal.
- 10.2 The manufacturer shall guarantee that all transformers furnished under this specification are of first class material and workmanship throughout, that they have been tested in accordance with this specification, and that the results of the tests comply with the requirements of this specification, and, in lieu of other claims against it, agrees to replace or repair:
- A. Any transformer found to be defective in material or workmanship or found not to be in compliance with the requirements of this specification before or during installation of the transformer.
  - B. Any transformer failing during normal and proper use within the manufacturer's guarantee period which shows defects of material or workmanship.

## PART 11 - APPROVED MANUFACTURERS

- 11.1 The following are approved manufacturers for transformers to be supplied for the project:
- A. ABB
  - B. Cooper
  - C. Howard Industries
  - D. Pauwels
  - E. Central Moloney
  - F. General Electric

END OF SECTION 16300

## SECTION 16422 - CAST-IN-PLACE CONCRETE

### PART 1 - INTRODUCTION

#### 1.1 SCOPE

- A. This specification covers the furnishing of all material, equipment, accessories, tools, services, transportation, labor, and supervision required for the supply and installation of cast in place concrete.

#### 1.2 CONCRETE

- A. Unless otherwise indicated, concrete shall be normal weight (145 pcf) ready-mixed concrete, conforming to ASTM C94.

#### 1.3 ITEMS INCLUDED

- A. This specification includes the following items:
  - 1. Concrete for foundations and structures
  - 2. Concrete for Slabs on grade
  - 3. Reinforcement
  - 4. Formwork
  - 5. Embedded Items, including Anchor Bolts

#### 1.4 CERTIFICATION

- A. The concrete manufacturer shall certify that the concrete delivered conforms to the specification for Ready-Mixed Concrete ASTM C94, and furnish the certification specified in Par. 14 of ASTM C94.

### PART 2 - CODES AND STANDARDS

#### 2.1 The following codes and standards of the latest revision shall be considered as part of this specification:

- A. American Concrete Institute, ACI 318, Building Code Requirements for Reinforced Concrete
- B. ACI 301, Specifications for Structural Concrete for Buildings
- C. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
- D. ACI 305, Recommended Practice for Hot Weather Concreting
- E. ACI 306, Recommended Practice for Cold Weather Concreting
- F. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures
- G. ACI 347, Recommended Practice for Concrete Formwork
- H. American Society for Testing and Materials (ASTM), as noted.
- I. American Welding Society D12.1, Recommended Practices for Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction.
- J. Concrete Reinforcing Steel Institute (CRSI), as noted.

## PART 3 - MATERIALS

### 3.1 CEMENT

- A. Unless otherwise noted, all cement shall be Portland Cement conforming to ASTM C150, Type II cement. All cement supplied shall be of one manufacturer.

### 3.2 WATER

- A. Water used in mixing shall be clean and free from deleterious amounts of acids, alkalis, organic matter, or other impurities likely to be injurious to concrete.

### 3.3 ADMIXTURES

- A. Chemical Admixtures shall conform to "Chemical Admixtures for Concrete" (ASTM C 494) and shall not be used unless prior approval in writing is obtained from the Engineer. Where approved, the admixture shall maintain or improve the strength and/or durability of concrete of the original design mix. Admixtures shall be used in strict accordance with the manufacturer's recommendations and shall be accompanied by the services of the qualified field representative of the manufacturer to supervise the use thereof. A certificate from an approved laboratory attesting that the admixture equals or exceeds ASTM C494, Type D will be required.
- B. Air Entraining Admixtures shall conform to "Specifications for Air-Entraining Admixtures for Concrete" (ASTM C 260). Air content shall be determined in accordance with ASTM C231. The agent and the cement proposed for use shall be selected well in advance of concrete placing. Approved air-entraining admixtures are as follows:
  - 1. Darex AEA (Grace Construction Materials)
  - 2. MB-VR (Master Builders Co.)
  - 3. Sika AER (Sika Chemical Corp.)
- C. The use of accelerators shall not be allowed.
- D. Calcium chloride shall not be used as an admixture.

### 3.4 AGGREGATE

- A. Fine aggregate shall conform to "Concrete Aggregates" (ASTM C33), except for gradation which shall be as follows:

| Sieve Size | Percent Passing  |
|------------|------------------|
| 3/8 inch   | 100              |
| No. 4      | 95-100           |
| No. 16     | 65-95            |
| No. 50     | 7-30             |
| No.100     | No More Than 7 % |

- B. Coarse aggregate shall conform to "Concrete Aggregates" (ASTM C33) One inch to No. 4 size.
- C. Aggregates for type V cement shall be sharp acid-resistant type silica rocks. Quartz, flintstone, etc. are preferred. Absolutely no carbonate rocks such as limestone, calcite, dolomite, magnetite, siderite, etc. shall be used.

### 3.5 CONCRETE DURABILITY AND QUALITY

- A. All concrete shall meet the durability and quality requirements specified in ACI 318, Chapters 4 and 5.



- B. The 28 day compressive strength,  $f'_c$ , of the concrete shall be not less than 4000 psi or as specified on the drawings.
- C. Method of proportioning shall be in accordance with ACI 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete."
- D. The determination of the water-cement ratio to attain the required strength shall be in accordance with ACI 301, Method 2 (For combinations of materials previously evaluated or to be established by trial mixes), and with ACI 211.1. In addition, the maximum water-cement ratio (by weight) shall be 0.45 and the minimum cement content shall be 5-1/2 sacks per cubic yard.
- E. From the test results of the aforementioned procedures, a curve shall be plotted showing relationship between the water-cement ratio and compressive strength, and the maximum water-cement ratio to be used shall be the value shown by the curve to produce the strength a minimum of 25 percent greater than the strength specified.
- F. The concrete mix design shall be submitted to the Engineer for approval prior to beginning of any concrete work.
- G. Maximum aggregate size shall meet the requirements of ACI 318, Section 3.3.
- H. Unless otherwise noted or approved, all concrete shall be air-entrained. Air entrainment shall be accomplished through the use of an approved admixture.
- I. Air Content

1. The air content shall be as follows:

- (a) 6 to 10 percent for 3/8 inch maximum aggregate size
- (b) 5 to 9 percent for 1/2 inch maximum aggregate size.
- (c) 4 to 8 percent for 3/4 inch maximum aggregate size.
- (d) 3.5 to 6.5 percent for 1 inch maximum aggregate size.
- (e) 3 to 6 percent for 1-1/2 inch maximum aggregate size.
- (f) 2.5 to 5.5 percent for 2 inch maximum aggregate size.

J. Slump

| Types of Construction:   | Slump in Inches |         |
|--|-----------------|---------|
|  | Maximum         | Minimum |
| Reinforced foundation walls, footings, and small mat foundations | 4               | 2       |
| Reinforced slabs, beams and walls                                | 4               | 2       |
| Equipment foundations  | 5               | 3       |
| Sidewalks, driveways, and slabs on ground                        | 4               | 2       |

K. Mixing, transporting and placing concrete shall conform to applicable portions of ACI 211, ACI 212 and ACI 304 and as specified herein.

### 3.6 REINFORCEMENT

A. Deformed Bars

- 1. Deformed reinforcing steel bars shall conform to ASTM A615, Grade 60 unless noted otherwise. Bars shall be tagged with mark number and size before shipment.

B. Coated Bars

- 1. If specified by the drawings, reinforcing bars shall be either galvanized or epoxy coated.

2. Galvanized coated reinforcement shall be Class I hot dipped after fabrication zinc coated in accordance with ASTM 767. If the galvanized surface is damaged prior to placement of concrete, it shall be repaired in accordance with ASTM A780.
3. Epoxy coated reinforcement shall be epoxy coated in accordance with ASTM A775. If the epoxy surface is damaged prior to placement of concrete, it shall be repaired with "3M Scottcoat 306" in accordance with manufacturer's specifications.

C. Welded Wire Fabric

1. Welded Wire Fabric shall conform to "Welded Steel Wire Fabric for Concrete Reinforcement" ASTM A185.

D. Steel Wire

1. All cold-drawn steel wire for concrete reinforcement shall be in accordance with ASTM A 82.

E. Synthetic Fiber Secondary Reinforcement

1. Synthetic reinforcing fibers shall be collated fibrillated polypropylene, as manufactured by Fibermesh, Inc. or equal.

F. Accessories

1. Accessories shall conform to CRSI Manual of Standard Practice of Reinforced Concrete Construction. Include all devices necessary for proper placing, spacing, supporting, and fastening steel reinforcement in place. Accessories shall be galvanized after fabrication if underside of concrete will be exposed.

G. Concrete Squares (Precast Reinforcing Chairs)

1. Squares shall be approximately two inches square and of a thickness adequate to provide the cover for the reinforcing steel as called for on the plans. The squares shall be made using a mixture of one part Portland Cement to three parts sand (fine aggregate) and the tie wires shall be cast integrally with each square.

### 3.7 FORM WORK

A. Design

1. Formwork shall be designed for loads and lateral pressures outlined in Chapter 1, Recommended Practice for Concrete Formwork (ACI 347) and wind loads as specified by the controlling local building code. Formwork design and construction are the responsibility of the Contractor.

B. Forms

1. Forms shall be constructed of wood, steel, or other approved material. Material shall be chosen based on strength and concrete finish requirements.

### 3.8 EMBEDDED ITEMS

A. Anchor Bolts and Sleeves

1. Unless noted otherwise, anchor bolts shall conform to ASTM A36 Steel as shown on the drawing. Sleeves, if required shall be of high impact plastic or schedule 40 steel pipe with sleeve bottom closures of mild steel. Furnish each bolt with one heavy hex nut and washer unless otherwise noted on the drawing.

B. Embedded Metals

1. Curb angles, frames, beams, ducts, etc., shall be fabricated of ASTM A-36 material, and in accordance with Specification for Division 5, "Structural and Miscellaneous Steel".

C. Waterstops

1. Unless otherwise noted on the drawings, waterstops shall be of the dumbbell or centerbulb type made from either rubber, neoprene or PVC. Type and material of waterstop shall be approved by the Engineer before installation.

D. Expansion Joint Filler

1. Filler shall be ½" thick and shall meet the requirements of ASTM D 1751 for bituminous type or ASTM D 1752 or ASTM D 2628 for nonbituminous type. Where required or shown on the drawings a non-impregnated compressible foam backer rod shall be installed in the expansion joint prior to applying joint sealer. The backer rod shall be 1/8 inch larger in diameter than the joint width and shall be placed in the joint so as to provide a clear depth above the backer rod from the finished concrete surface equal to ½ the joint width.

E. Joint Sealer

1. Unless otherwise noted, sealer shall conform to ASTM D 1190. Sealant used in expansion joints requiring backer rods shall be a non-priming urethane sealant conforming to ASTM C 920.

F. Subsurface Covering (Vapor Barrier)

1. Polyethylene sheeting 6 mil (0.006") thick natural clear conforming to commercial standard CS 238 or ASTM D 2103.

G. Felt Joints

1. 15 lb asphalt felt shall conform to ASTM D 250.

H. Fiber Board

1. Tempered hard board shall conform to commercial standard CS 251.

## PART 4 - EXECUTION

### 4.1 PREPARATION

- A. In no case shall concrete be placed on muddy, spongy, or frozen subgrade.
- B. All wood scraps and debris shall be removed from the areas in which concrete is to be placed.
- C. All areas where concrete is to be placed shall be thoroughly cleaned to ensure proper placement and bonding.
- D. Forms and subgrade shall be wetted and all standing water removed prior to placing concrete.
- E. All transporting and handling equipment shall be thoroughly cleaned.

## 4.2 FORMWORK

### A. Installation

1. Forms shall be constructed to the shape, line, and grade required and shall be maintained sufficiently rigid to prevent deformation under load, including placing and compacting of concrete. Set forms and screens for floor and decks to provide uniform slopes to drains and positive drainage for exterior slabs and steps. Forms shall be tight enough to prevent leakage of mortar. Formwork shall be secured to prevent sagging, yielding, bulging, depressions, waves, or other defects in the finished work. Forms shall be smooth and free from warp. Temporary openings shall be provided at base of column and wall forms for cleaning and inspection. All debris including mud shall be removed before placing concrete. Use of patented prefabricated panel sections for forming straight wall sections shall receive prior approval of type and procedure including type of ties to be used. Lumber once used shall be carefully cleaned and oiled before reuse.

### B. Earth Sides

1. Earth sides may be utilized if clean cut and stable at time of concrete placing. Earth must be undisturbed or compacted to 95% density in accordance with ASTM D 1557, and free from surface water.

### C. Chamfering

1. Exposed corners of concrete shall have 3/4" chamfers unless shown otherwise.

### D. Form Treatment

1. Board Forms: Keep wet previous to placing concrete; wet thoroughly just before placing.
2. Plywood Forms: For surfaces to be painted use silicone-type bondbreaker, Burke, West Chemical or approved equal, applied in accordance with manufacturer's directions. Coat other surfaces with approved stainless form oil, using minimum quantity required for satisfactory removal.
3. Metal Forms: Approved-type release compound, applied in accordance with manufacturer's directions.

### E. Form Removal

1. Side forms of walls and beams can be removed after 1 to 3 days. Load-supporting forms and shoring shall not be removed until after 7 days or two-thirds of designed 28 day compressive strength is obtained or the 7-day test cylinders have been tested and results indicate an average strength adequate to support the load imposed on the concrete. All forms shall be completely removed after setting of concrete together with all temporary supports, etc., employed for construction purposes. Forms shall be readily removable without hammering or prying against the concrete. Days having temperatures below 40 °F are not to be counted for form removal unless thermal protection for the concrete has been provided.

## 4.3 REINFORCEMENT

### A. Detailing and Fabrication

1. Reinforcing steel shall be detailed and fabricated in accordance with ACI 315.
2. The fabricating contractor shall prepare complete placing drawings and bending schedules. All drawings, thus produced, shall be submitted to the Engineer for approval. No fabrication of reinforcing steel shall be done until drawings have been approved.

## B. Splicing

1. Bar splices shall be made in accordance with ACI 318 Chapter 12 unless noted otherwise on the design drawings. Any deviation will require approval of the Engineer.
2. When welded splices are specified on the design drawings, the welding shall conform to AWS D12.1. Unless specified, welding of reinforcement is prohibited.
3. Splices in welded wire fabric shall be made by lapping a minimum of one spacing of outermost cross wires of each fabric sheet plus two inches.

## C. Installation

1. Before being placed, reinforcing shall be free from loose flaky rust, oil, grease, mud, or other coating, including ice that would reduce or destroy the bond. Reinforcement shall be accurately placed and properly secured in position by precast concrete squares, metal chairs or spacers. The use of heat to bend or straighten reinforcing will be permitted only if the entire operation is approved by the Engineer. Tolerances, spacing, splices, and concrete protection to conform with Chapter 7 and 12 of the ACI 318 Building Code.

## D. Ties

1. With the exception of temperature reinforcement, which shall be tied to main steel, reinforcement shall be accurately placed and securely tied at all intersections and splices with 18 gauge black annealed wire, and shall be securely held in position during the placing of concrete by spacers, chairs, squares, or other approved supports. Wire tie ends shall point away from the form. Unless otherwise indicated, the number, type, and spacing of supports shall conform to ACI 315 Manual.

## E. Stirrups

1. All stirrups, except ties, shall be held in place by two spacer bars extending the full length of the beam or girder.

## F. Mesh

1. Reinforcing mesh shall be installed by one of the following methods to obtain the spacing indicated on the drawings:
  - (a) Deposit a layer of concrete and strike off at the level required for the indicated spacing. Lay the mesh on the struck-off surface, place reinforcing bars, if required, and then continue pouring to full slab thickness. Use this method only when position of mesh is critical, as specified on the drawings or as directed by the Engineer.
  - (b) Place mesh on preformed concrete blocks wired to the mesh, pour concrete, and adjust mesh as required. This is the preferred method when exact positioning is not specified as critical.

## G. Slabs on Grade

1. Reinforcing for re-entrant corners and perimeter steel around the edge of each pouring unit shall be ½" diameter (#4) deformed bars. Bars used as dowels in joints shall be ½" diameter plain round bars 2' long and spaced on 24" centers, unless otherwise indicated on detailed drawings.

## H. Watertight Construction

1. Standard accessory items (i.e. chairs, etc.) shall not be used in the construction of tanks, reservoirs, basins or other structures to contain water, waste water, or sewage. All reinforcing steel in the walls, beams, columns and slabs of such structures shall be supported

on and held away from the forms by using precast concrete "squares" so that no metal is exposed on the face of the concrete when the forms are stripped.

I. Synthetic Fiber Secondary Reinforcement

1. Synthetic fibrous reinforcement: Collated, fibrillated polypropylene with a mix ratio of 1.5 pounds of fiber to 1.0 cubic yards of concrete is to be used in all concrete used for curb, gutter, sidewalk and all other exterior flatwork.

4.4 EMBEDDED ITEMS

- A. No pours are to be made until all embedded items, anchor bolts, electrical conduits, steel frames, pipe supports, etc., are properly positioned and secured and required inspections of same completed. The contractor shall be responsible for and coordinated with other trades to obtain necessary data and information.
- B. All sleeves, inserts, anchor bolts, waterstops, and other embedded items shall be positioned accurately and supported against displacement.

C. Anchor Bolts

1. Fabrication: Anchor bolts shall be complete with flat plate bolt washer, semi-finished hexagon nut and, if required, anchor bolt sleeve. Anchor bolt threads shall be N.C. Class 1 fit. Welding shall be in accordance with AWS recommended practice.
2. Installation: Anchor bolts shall be set true to the lines and grades shown on the drawings and shall be set plumb and be securely braced to prevent displacement during placing of concrete. Threads shall be protected by coating with oil or grease and encasing them in burlap or paper. Upon completion of concrete placement, bolts shall be rechecked for correct location and elevations. Should any bolt exceed acceptable tolerances such corrections as are necessary shall be made at no additional cost.
3. Anchor Tolerances: Tolerance limits in setting of anchors and anchor bolts shall be as follows:
  - (a) Location, sleeved: 3/16 inch
  - (b) Location, unsleeved: 1/8 inch
  - (c) Projection: plus 1/4 inch, minus 0 inch

D. Embedded Metals

1. Fabrication

- (a) Curb angles, frames, beams, etc., shall have suitable anchors securely welded on centers not exceeding two feet. Anchors shall also be positioned within 6 inches of ends and corners. All joints, corners, splices, etc. shall be seal welded and the exposed surfaces ground flush. All metal surfaces shall be free from scale, rust, oil, grease or other contaminants and those not intended for contact with the concrete shall be coated with zinc chromate primer, unless otherwise specified on the drawings or by the Engineer.
- (b) The fabricated length of pipe sleeves shall be equal to the thickness of concrete they penetrate. Ends of pipe sleeves shall be cut square and flush with the face of concrete. Unless otherwise specified or shown on the Drawings, pipe sleeves shall be secured against movement by welding a ring or flange around the outside midpoint of the sleeve.
- (c) Ducts shall be fabricated as shown on the Drawings.

2. Installation

- (a) All embedded curb angles, beams, frames, pipe sleeves, etc. shall be set true to the lines and grades shown on the drawings. Embedded items shall be secured and braced to

prevent shifting during concrete placing. Where dissimilar metals are to be embedded in direct contact with one another, the contacting surfaces shall be heavily coated with bituminous mastic or other Engineer-approved surface treatment to prevent galvanic coupling.

#### 4.5 MIXING CONCRETE

- A. The mixer and mixing time shall be in accordance with ACI 304. Hot weather concreting shall comply with ACI 305, and cold weather concreting with ACI 306.
- B. No additional water shall be added to batched concrete without the permission of the Engineer. Such water shall be incorporated by additional mixing equal to at least half of the total mixing required for the batch. Any addition of water above that permitted by the limitation on specified water-cement ratio, shall be accompanied by a quantity of cement sufficient to maintain the proper water-cement ratio.
- C. Concrete shall be mixed only in such quantities as are required for immediate use. The maximum allowable time between charging of the material in the mixing drum and final placing for mean ambient temperatures below 90°F shall be ninety (90) minutes or 300 drum revolutions, whichever ever comes first. Concrete to be delivered when the mean ambient temperature exceeds 90°F shall be mixed and delivered in accordance with the requirements of ACI 305 "Recommended Practice for Hot-Weather Concreting". Concrete not placed within these time limits, or if an initial set has developed, shall not be used. Tempering concrete by adding water or by other means will not be permitted.
- D. Ready Mix Concrete: The Contractor is to provide a computerized ticket with each batch to be delivered to the project manager that includes the following information:
  - 1. Name of ready-mix batch plant.
  - 2. Serial number of ticket.
  - 3. Date and number of truck.
  - 4. Name of Contractor.
  - 5. Specific designation of job (name and location).
  - 6. Volume of concrete (number of cubic yards).
  - 7. Time batch was dispensed to truck.
  - 8. Readyng of revolution counter at first addition of water.
  - 9. Signature or initials of ready-mix representative.
  - 10. Type and brand of cement.
  - 11. Amount of cement (can be indicated by weight or quantity).
  - 12. Total water content by producer (can be indicated by weight or quantity).
  - 13. Water added by receiver of concrete and his initials (can be indicated by weight or quantity).
  - 14. Admixtures and amount of same.
  - 15. Maximum size of aggregate.
  - 16. Weights of fine and coarse aggregates.
  - 17. Indication that all ingredients are as previously certified or approved.

#### 4.6 PLACING CONCRETE

- A. Concrete shall not be placed prior to a recorded pre-placement inspection and/or authorization to proceed by the Engineer. The Contractor must obtain the project manager's approval of all dimensions, steel location, condition of forms, and placing equipment at least four (4) working hours prior to placing any concrete.
- B. The slump may be increased up to 6 inches if concrete pumping is to be used. The proposed mix design for pumped concrete shall be approved by the Engineer.
- C. Conveying and placing of concrete shall be in accordance with ACI 304.

- D. Each day's pour shall be properly scheduled to assure that concrete surfaces can be finished correctly and the use of cold joints can be minimized.
- E. All concrete shall be mechanically vibrated, except for slabs on grade that are six inches or less in thickness.
- F. Concrete shall be placed in layers not over 24 inches deep. Each layer shall be consolidated by mechanical internal-vibrating equipment supplemented by hand spading, rodding, and tamping to work concrete into all angles and narrow places. Duration of vibration shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation. Vibrators shall be applied vertically and at uniformly spaced points not farther apart than the visible effectiveness of the machine. The vibrator shall not be inserted into lower courses that have begun to set. Vibrators shall not be used to transport concrete inside forms. The use of form vibrators or form tamping will not be permitted.
- G. The free fall of concrete from the end of the spout or chute, or from a transporting vehicle, shall not exceed 10 feet for thin walls (10 inches or less in thickness) nor more than 5 feet for other types of construction.
- H. A tremie or flexible metal spout shall be used when the distance through which concrete must be dropped vertically exceeds the maximum specified above. Flexible metal spouts shall be composed of conical sections not more than three feet long, with the diameter of the outlet and the taper of the various sections such that the concrete will fill the outlet and be retarded in its flow.
- I. Chutes, troughs, or pipes used as aids in placing concrete shall be arranged and used so that the ingredients of the concrete will not be separated. Chutes and troughs shall be of metal or metal-lined. When steep slopes are necessary, the chutes shall be equipped with baffle boards or a reversed section at the outlet. Open troughs and chutes shall extend, if necessary, down inside the form or through holes left in the forms; or the ends of such chutes shall terminate in vertical downspouts. All chutes, troughs, and pipes shall be kept clean and free from coatings or hardened mortar by a thorough flushing with water before and after each placement. Water used for flushing shall be discharged outside of the forms.
- J. The concrete shall be deposited, as nearly as possible, in its final position and shall not be caused to flow laterally in the form for any considerable distance. Each pour shall be completed in a continuous operation with no interruptions in excess of forty-five minutes. Each layer shall be placed and compacted before the preceding layer has taken initial set.
- K. The placing sequence shall always be arranged to allow for the effects of settling and shrinkage. Walls 10'- 0" and over in height shall be stopped about 1 foot short of the top and allowed to settle one hour minimum before topping out. Walls and columns bearing superimposed slabs or beams shall be allowed to settle a minimum of two hours before pouring slabs or beams. Laitance shall be removed before pouring superimposed structural members.

#### 4.7 BONDING

- A. The existing surfaces shall be thoroughly cleaned of all foreign material and laitance before depositing new concrete on old concrete or against concrete which has set. Existing surfaces shall be coated with a bonding agent as approved by the Engineer.

#### 4.8 JOINTS

- A. Construction and control joints shall be placed as indicated on drawings (when shown).
- B. Use of construction and control joints, when not shown on the drawings, shall be in accordance with ACI 318, Chapter 6.4, and subject to approval of the Engineer.



- C. Waterstops shall be installed as shown on the drawings, forming a continuous diaphragm in each joint. Support for waterstops shall be provided and waterstop material shall be protected from damage. Field joints in waterstops shall be fabricated in accordance with manufacturer's instructions.
- D. Saw cutting of contraction joints shall be done as soon as concrete hardens sufficiently (normally 4-12 hours) so as not to be torn or damaged by the blade. Sawing shall not be done while concrete temperature is falling. Construction and control joints shall be filled with an approved sealant, and premolded joint filler, and/or backer rod as shown on the drawings.
- E. Joints not specified on the design drawings shall be in accordance with ACI 301, Chapter 6, and Section 11.5.
- F. All reinforcing shall be continued across construction joints. Keys shall be provided only if required by the design drawings.
- G. When called for on the design drawings, the concrete surface at construction joints shall be roughened uniformly to approximately 1/4 inch, and laitance, loosened aggregate or damaged surface concrete shall be removed.
- H. Paving or slab construction joints, when not specified on the design drawings, shall be located at column centerlines and at intermediate intervals so that each panel shall be not more than 400 square feet in the area, unless slab is reinforced, in which case the area shall not be more than 600 square feet. Maximum spacing of construction joints in unreinforced slabs shall not exceed twice the slab thickness in inches (i.e., 6 inch slab: 12 feet) nor 1-1/2 times the width for narrow slabs such as sidewalks. Concrete shall be placed in checker board patterns or in alternate paving lanes utilizing construction and contraction joints to provide panels of the size shown on the drawing (when shown).

#### 4.9 FINISHING CONCRETE

- A. Form ties shall be broken back 1 inch from the surface of the concrete. The remaining holes shall be filled by seal patching using a 1- to -2 mix of cement-sand mortar.
- B. All voids and honeycomb in formed concrete shall be filled with a 1- to -2 cement-sand mortar mix. Form ridges and other projections shall be removed immediately, after forms are removed. Exposed form concrete shall be rubbed with a carborundum brick and a thin cement grout shall be applied as necessary to produce a true, even, finished surface. Grout shall extend at least 3" below finished backfill grade on grade walls.
- C. Concrete surfaces left low for grouting shall be roughened to expose aggregate, and all loose particles and laitance shall be removed. Anchor bolt threads shall be wire brushed, and greased, after concrete has set. Nuts and washers shall be placed on the bolts.

#### 4.10 FINISH FOR FLOORS AND WALLS

- A. Interior building slabs including pit floors shall be screeded, floated, and steel troweled.
- B. Exterior slabs shall be screeded, floated, troweled, and broomed.
- C. Special care shall be exercised on floors that have drains or trenches. Floors shall be sloped uniformly to provide even fall for drainage.

#### 4.11 SCREEDING, FLOATING, TROWELING, BROOMING & NONSLIP FINISHING

- A. Surfaces shall be screeded to the elevations shown on the drawings. "Con-Film" or Engineer-approved equal shall be sprayed on the screeded surface in conformity with manufacturer's directions if the air temperature is expected to reach 80°F or above before cure is complete.

- B. Floating shall start as soon as the screeded surface has stiffened sufficiently. Floating shall be performed as necessary to produce a smooth, even, textured finish. Floating shall be performed by hand using magnesium tools.
- C. The slab surface shall be tested for accuracy with a straight edge after the first floating finish is completed. Any depressions shall be filled and high areas shall be cut down and reworked. Straight edge testing and refloating shall continue until there are no deviations of more than 1/8 inch under a ten foot straight edge.
- D. Interior slabs shall be troweled except as noted on drawings or specified otherwise. Steel troweling shall begin after straight edge testing is finished and while concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint. Steel troweling shall produce a smooth troweled finish per ACI Standard 301, Section 11.7.3 "Trowel Finish". Time lapse and number of trowelings to produce a hard surface will vary depending on weather conditions.
- E. Exterior slabs and other surfaces, as noted, shall be broomed after final floating to provide a nonskid surface. A soft bristled push broom shall be used, with a swirling motion.
- F. Surfaces indicated shall have a nonslip finish obtained by sprinkling not less than 1/4 pound of abrasive aggregate over each square foot of the screeded and floated concrete, and finishing immediately with a steel trowel. The abrasive aggregate shall consist of not less than 55 percent aluminum-oxide or silicon-carbide abrasive ceramically bonded together to form a homogeneous material that will be sufficiently porous to provide a good bond with Portland cement. The aggregate shall have an abrasive hardness of not less than 40 as determined by the test for wear resistance in the National Bureau of Standards Report BMS 98.

#### 4.12 CURING AND SEALING

- A. All finished concrete shall be cured by a curing method compatible with the final floor finish for a minimum of 7 days in accordance with ACI 301 Chapter 12. One or more of the following methods may be used, if approved by the Engineer, except where a specified curing method is called for:
  - 1. Water curing by ponding or continuous wetting of sand or burlap.
  - 2. Form curing by leaving on the forms and wetting for seven days.
  - 3. An approved sprayed-on curing compound applied in accordance with the manufacturer's instruction.
  - 4. Steel troweled floor slabs, not covered with other materials shall receive two coats of "Cenco Seal 301" surface hardener applied after all other equipment and work in the building has been installed and/or completed and the floor has been thoroughly cleaned of all dust, dirt, masks, and foreign matter.

#### 4.13 COLD WEATHER CONCRETING

- A. Thorough preparation for protection against cold weather damage to concrete shall be made well in advance. Cold weather concreting shall be performed in accordance with ACI 306.
- B. Concrete shall be protected from freezing for not less than the first 48 hours after placing after the first frost, or when the mean 24-hour temperature at the job site falls below 40°F.
- C. The placing temperature of the concrete shall be maintained above 50°F when the mean 24-hour temperature falls below 40°F.
- D. The temperature of fresh-placed concrete shall be between 50 and 60°F.

#### 4.14 HOT WEATHER CONCRETING

- A. Thorough preparation for protection against hot weather damage to concrete shall be made well in advance. Hot weather concreting shall be performed in accordance with ACI 305.
- B. The maximum concrete temperature, at time of placement, shall be limited in accordance with ACI 305, Figure 2.1.5. The evaporation rate of the mixing water shall not exceed 0.2 pounds of water per square foot per hour.
- C. One or more of the ingredients may have to be cooled to keep the temperature of the concrete from being excessive at time of placement. The replacement of part of the mixing water with an equal weight of crushed ice is recommended for effective cooling per ACI 305, figure 2.3.6.
- D. In-place concrete shall be protected and cured so as to minimize drying and absorption of heat.

#### 4.15 COLORED CONCRETE FOR UNDERGROUND DUCT ENVELOPE

- A. Materials and Proportioning
  - 1. All colored concrete shall have a specified compressive strength of 2,000 psi at 28 days. Maximum aggregate size shall be 3/8 inch.
  - 2. Concrete shall be mixed for at least ten minutes after color admixture has been added.
- B. Color Admixture
  - 1. All colored concrete for underground electrical conduit envelopes shall be colored RED. One pound of Red Oxide Color, C. K. Williams and Company, RD-3097, or authorized substitute, shall be used per sack of cement.

#### 4.16 PUMPED CONCRETE

- A. The use of pumped concrete shall be approved in each case by the Engineer.
- B. The proposed mix design for each class of concrete to be pumped, including all necessary background data of test results, shall be submitted to the Engineer for approval.
- C. All slump and cylinder test samples shall be taken from the end of the discharge line.
- D. Cutting and patching on any portion of the work after it has been completed shall be done only with the approval of, and as instructed by the Engineer.
- E. Forms, equipment, protective coverings, and rubbish resulting therefrom shall be removed from the premises upon completion of the work.

### PART 5 - TESTING AND INSPECTION

#### 5.1 INSPECTION

- A. All forms, reinforcement, and anchor bolts shall be inspected and approved by the Owner's inspector before concrete is placed. If work is found unsatisfactory, the work shall not proceed until all defects have been remedied. Repaired work shall be approved by the Owner's inspector. Such approval will in no way relieve the contractor of his obligation to produce finished concrete as required by the drawings and specifications.

## 5.2 TESTING

- A. Testing and acceptance of tests of concrete shall be done in accordance with ASTM C31, C39, C94, C143, C172, and C173, D75 and C136.
- B. Provide details for testing and inspection schedule. Concrete testing shall be coordinated by the Owner's project manager and paid for by the owner. Additional testing due to test failure shall be specified to be at the Contractor's expense. Testing requirements should include:
  - 1. Slump: Test on each truck load.
  - 2. Air Entrainment: Test on every truck load.
  - 3. Temperature: Test on every truck load.
  - 4. Strength: Three cylinder every 50 cubic yards ([1] 7 day and [2] 28 day).
- C. The Contractor shall supply concrete for all tests.
- D. Concrete shall be sampled, cured, tested and accepted for compressive strength in accordance with ASTM C172, C31, C39, and C94. Compressive test cylinders shall be prepared in sets of three cylinders for each test. Specimens for each set shall be obtained from the same batch of concrete after about one half of the batch has been placed in the forms. The minimum rate of sampling shall be as follows:
  - 1. Structures and Foundations
    - (a) One set per 100 cubic yards of concrete. At least one set shall be obtained for each structure or foundation, except when placing a number of items, each smaller than 15 cubic yards, one set per 15 cubic yards shall suffice.
    - (b) Floors and Slabs at Grade
      - (1) One set per 50 cubic yards of concrete.
    - (c) Underground Duct Envelopes and Fireproofing
      - (1) One set taken at the beginning of each day's concreting work. Subsequent testing may be performed at the discretion of the Engineer.
    - (d) All Other Concrete
      - (1) Same as Paragraph 5.2D1a above.
- E. Test cylinder sets shall be dated, numbered consecutively, and identified as to location.
- F. All cylinders shall be immediately stored under wet sand or burlap for about 24 hours after preparation. All vibration or impact shall be avoided during this critical period.
- G. After initial storage, the cylinders (still in their molds) shall be packed in sealed polyethylene bags, wet sand or other resilient material for shipment to the testing laboratory.
- H. Concrete slump tests shall be made in accordance with ASTM C 143 and shall be taken as necessary to assure well-placed concrete.
- I. In-Place Tests: Where questions exist as to the quality of the concrete placed, Engineer may require tests per ASTM C42 or order a load test on structures as outlined in Chapter 20 of ACI 318, Building Code Requirements for Reinforced Concrete.

## PART 6 - SUBMITTALS

- 6.1 Two (2) copies of the following (unless noted otherwise) shall be submitted to the Engineer for review and approval:
- A. Design of concrete mixes in accordance with this specification and ACI 301, Chapter 3.
  - B. Reinforcing steel and embedded items shop drawings, bar lists and bending and erection drawings. Two (2) sets of these documents shall accompany the first load of reinforcing delivered to the job site.
  - C. Test Reports and material certifications as noted elsewhere in this specification, and/or on the drawings.
  - D. One (1) reproducible of the final reinforcing steel and embedded items shop drawings shall be forwarded to the Engineer when they are issued to the shop.

## PART 7 - EXECUTION

### 7.1 MATERIAL PREPARATION AND HANDLING

- A. Non-Shrink Grout
  - 1. Non-Shrink grouts shall be mixed, handled, applied and installed in strict accordance with the manufacturer's instructions and recommendations.
  - 2. The non-shrink grouts specified herein are handled and mixed in a manner similar to Portland Cement grouts. The consistency for flowable or dry-pack grouts is controlled by the water content.
- B. Epoxy Grouts
  - 1. Epoxy Grouts shall be handled, mixed, applied and installed in strict accordance with the manufacturer's instructions and recommendations.
  - 2. Epoxy grouts have a relatively short pot life and must be used immediately after mixing. Pot life, mixing times and installation period vary with temperature conditions, refer to manufacturer's instructions and recommendations.
- C. Portland Cement Grout
  - 1. A primary requisite is that the mix readily and completely fill the spaces to be grouted. The consistency of the mix required to accomplish this is controlled by the amount of water used. The mixture shall be consistent with minimum water content and shrinkage necessary to accomplish the intended purposes. The following are recommended grout proportions:

| Use     | Grout Thickness                           | Mix. Proportions                                 | Max. Water<br>Gals./Sack<br>of Cement |
|---------|---|--|---------------------------------------|
| General | One inch and over, but less than 2 inches | One Sack Portland cement to 2 cubic feet of sand | 6                                     |
| Fluid   | Under one inch                            | One sack Portland cement to 1 cubic foot of sand | 5                                     |
| Stiff   | 2 inches and over                         | One sack Portland cement to 2 cubic feet of sand | 6                                     |

- 2. Dry materials shall be thoroughly mixed before the addition of any water.
- 3. Grout shall not be retempered by the addition of water.

#### D. Epoxy Bonding Agents

1. Epoxy bonding agents shall be handled, mixed, and applied in strict accordance with the manufacturer's recommendations.

### 7.2 INSTALLATION

#### A. Cleaning

1. Surfaces to be grouted shall be thoroughly roughened and cleaned of all foreign matter and laitance. Anchor bolts, anchor bolt holes and the bottom of equipment and column base plates shall be cleaned of all oil, grease, dirt and loose material.

#### B. Wetting

1. Immediately prior to grouting with either Portland Cement or non-shrink grout, the concrete surface to be grouted shall be thoroughly wetted with water.

#### C. Drying

1. For epoxy grout installations, all surfaces which will come into contact with the grout must be absolutely dry and clean.

#### D. Anchor Bolt Sleeves

1. Water and debris in all anchor bolt sleeves shall be removed before grouting is started. All anchor bolt sleeves shall be completely filled with grout unless otherwise indicated on the drawings.

#### E. Positioning

1. Units to be grouted shall be set in their exact position and at their exact elevation by means approved by the Engineer prior to grouting.

#### F. Installation Procedures

1. Grouting, once started, shall proceed continuously and be accomplished quickly. The installation procedures shall be such as to insure full contact with all surfaces, complete filling of the grout space, release of all entrapped air, no segregation of materials, no bleeding and completion of grouting before any initial set.

#### G. Large Areas

1. When large areas are to be grouted, grout holes shall be provided in the base unit. Grout shall be installed through such holes by pressure grouting.

#### H. Thickness

1. Grout thickness shall generally be a minimum of one inch. For large or heavy units, the thickness may be greater.

#### I. Inspection

1. All grout installations shall be inspected and approved by the Owner's inspector prior to placement of the grout.

J. Surface Preparation for Bonding

1. The surface of existing concrete shall be cleaned of grease, oil, paint, ice, laitance, and other coatings, and shall be mechanically roughened to expose the aggregate. Thoroughly soak the surface until absorptions stop, and then remove free water before applying bonding mixtures.

NOTE: If bonding agent manufacturer recommends dry surface, thoroughly dry in accordance with manufacturer's recommendations before applying.

7.3 FINISHING

A. Trimming

1. After sufficient set has been attained, excess grout shall be trimmed away on a line flush with the bottom of the equipment base. The finish surface shall be troweled smooth and shall slope away from the base a minimum of 1/4" in 12". Form and seal epoxy grout per manufacturer's instructions.

B. Curing

1. Grout shall be suitably cured. During cold weather, provisions shall be made to prevent freezing.

7.4 GUARANTEE

- A. The Contractor shall furnish the Draper Prison with a written two (2) year guarantee for concrete materials and workmanship, including material and labor for total removal and replacement. The Contractor shall immediately place in satisfactory condition in every particular, any such guaranteed work upon written notice from the project manager and make good all damage to the buildings and grounds caused by said work, without cost to the Draper Prison. All guarantees shall start from the date of written substantial completion.

END OF SECTION 16422

## SECTION 02450 - CONSTRUCTION BARRICADE STANDARDS

### PART 1 -

#### 1.1 GENERAL

- A. The purpose of this document is to define the responsibilities of the contractor working on the project pertaining to protection of their work and protection of the general public from the hazards of their work. They shall be used with standard safety practices and other safety requirements such as OSHA. They represent minimum requirements for barricades when enhanced barricade specifications are not included in bid documents. All barricades shall be highly visible. They shall be constructed and positioned to not be a hazard in any manner.
- B. Obtain permission from the Owner for all barricades requiring supports installed below surface grades. The contractor shall be responsible for restoring all damage to existing utilities, landscape and pavements resulting from installation of barricades. This includes damage done by pedestrians and/or vehicles when routed around barricades. Restoration shall meet the requirements of the Owner.

#### 1.2 CONSTRUCTION LIMITS

- A. When the construction project is confined to a specific area, the entire area is to be fenced and gates used to control access. Fences shall be a minimum of six feet high and be constructed of all new materials. Fences shall be installed on straight, true lines with the fence fabric stretched taut. Posts supporting the fabric shall be sized to support the fabric, associated wind loads and be nonclimbable. Gates shall be locked with the contractor's lock and appropriate Owner locks.

#### 1.3 EXCAVATIONS

- A. Open excavations within construction areas where perimeter fencing exists shall be barricaded by highly visible tape, sawhorse-type stands, cones, etc., to protect the contractor's employees and visitors to the site.
- B. Open excavations outside construction areas that are perimeter fenced or on projects without perimeter fencing shall be barricaded by high visibility (yellow) fences. Fences shall be a minimum of five feet high and be constructed of all new or like-new materials (Conwed lightweight safety fence or equal). Fences shall be installed on straight, true lines with the fence fabric stretched taut. Post (T-stakes or better) supporting the fabric shall be sized and spaced to support the fabric and associated wind loads. (See Traffic and Pedestrian Control below for additional requirements associated with this section.)
- C. Fencing for trench excavations shall barricade the trench, excavated material and material to be placed in the trench. As trenching work progresses, fencing around areas backfilled to grade and cleared of hazards may be moved to new locations requiring fencing. Materials shall not be reused if not in like-new condition.

#### 1.4 TRAFFIC CONTROL

- A. Construction work will at times require temporary closure to vehicular access of parts of the facility. These temporary closures must be requested by the contractor in writing through the Owner. Requests must be made a minimum of seven days in advance of desired closure date. Every effort will be made to accommodate closure on desired date, but closure on date requested is not guaranteed.



## 1.5 PEDESTRIAN CONTROL

- A. When pedestrians are routed around construction areas, additional barricades will be required to prevent damage to adjacent landscaped areas. Barricades shall be placed to route pedestrians around affected areas using existing paved surfaces. These barricades shall meet the requirements for open excavations outside perimeter fences.
- B. When routing pedestrians around an area on existing pavements is shown to be a hardship, the contractor may provide temporary walking surfaces across existing landscaped areas. These surfaces shall be constructed of a durable material with a slip-resistant surface. The use and placement of temporary walking surfaces shall be approved in advance by the Owner. The contractor shall restore all landscaped areas damaged by the placement of walkways.

## 1.6 PROTECTION OF EXISTING TREES/ VEGETATION

- A. Existing trees and vegetation located in and near construction areas that are to remain shall be protected. Barricades meeting the requirements for excavations outside perimeter fences shall be placed outside the drip line of these trees.
- B. Should limited space require the area within the drip line of the trees be used for maneuvering of vehicles or access to the project, then the following requirements shall be met: The area within the drip line of the tree shall be covered with weed barrier or similar construction fabric. A six-to eight-inch layer of gravel roadbase shall be placed over the fabric to distribute weight. When the area is no longer required for use by the contractor, the gravel and fabric shall be removed.
- C. Watering trees to maintain existing health is required of all contractors under all circumstances.

END SECTION 02450

## SECTION 02480 - LANDSCAPE RESTORATION WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and other Specifications, apply to work specified in this section.

#### 1.2 DESCRIPTION OF WORK

- A. Extent of Landscape Work is indicated on drawings and including but not limited to the following:
  - 1. Provide and install all materials, operations, and labor as indicated on drawings, schedules, and as specified herein to complete all Landscape Work.
  - 2. Restoration and protection of existing Landscape as herein described.
  - 3. Protection of existing site objects, conditions, and utilities.
- B. The Contractor will maintain watering to landscaping and trees (existing and new) for all construction areas.
- C. The landscape restoration under this project will use plants of the same type as presently found in each construction area.
- D. Subgrade Elevations
  - 1. Excavation, filling, and grading required to establish elevations shown on drawings are not specified in this section; see drawings.

#### 1.3 QUALITY ASSURANCE

- A. Subcontract
  - 1. Subcontract landscape work to a single firm specializing in landscape contracting work.
    - (a) Supervision
      - (1) Landscape Contractor shall give the Work his personal supervision. In his absence he shall leave a responsible representative in charge who shall have the authority to receive and execute orders from the Engineer.
    - (b) General
      - (1) Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.
    - (c) Standards
      - (1) Provide trees, shrubs, and plants of quantity, size, genus, species, and variety shown and scheduled for Landscape Work and complying with recommendations and requirements of ANSI Z60.1 "American Standards of Nursery Stock". Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun scaled, injuries, abrasions, or disfigurements. Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

2. Do not make substitutions

- (a) If specified landscape material is not obtainable, submit non-availability to the Engineer, together with proposal for use of equivalent material. Do not proceed with substitutions until Contractor receives written approval to do so by the Engineer.

3. Reference Standards

- (a) This section shall be supplemented by the requirements of the Williams-Steiger Occupational Safety and Health Act, commonly known as OSHA. All conditions of the Act and the Utah Occupational Safety and Health Standard for construction Support P, Part 1926, shall apply unless superseded or modified by clauses in this specification.

4. Labeling

- (a) Label at least one tree and one shrub of each variety with a securely attached, waterproof tag bearing legible designation of botanical and common name.

5. Inspection

- (a) The Engineer and Draper Prison Site Utilities Landscape Architect will inspect trees and shrubs at the site before planting, for compliance with requirements herein specified. Landscape Architect retains the right to further inspect trees and shrubs for size and condition, and to reject unsatisfactory or defective material at any time during progress of the work. Remove rejected trees or shrubs immediately from the project site.

1.4 SUBMITTALS

A. Certification

- 1. Submit certificates of inspection as required by governmental authorities. Submit other data substantiating that materials comply with specified requirements.

B. Maintenance Instructions

- 1. Submit typewritten instructions recommending procedures to be established or by owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials

- 1. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

B. Sod

- 1. Time delivery so that sod will be placed within 24 hours after stripping. Protect sod against drying and breaking of rolled strips.

C. Trees and Shrubs

- 1. Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by Landscape Architect. Do not bend or limb-tie trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. Do not drop balled and burlapped stock during delivery.

- D. Deliver Trees and Shrubs after preparation for planting has been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.
- E. Do not remove container grown stock from container until planting time.

#### 1.6 JOB CONDITIONS

- A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape restoration work required.
- B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.
- D. Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.
- E. Coordination with Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Architect. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

#### 1.7 SPECIAL PROJECT WARRANTY

- A. The Contractor is responsible for a period of any four (4) consecutive growing months (growing months to be defined as April, May, June, July, August, and September) to maintain all plant material in a healthy and growing condition by weeding, cultivating, fertilizing, controlling insects and diseases, re-guying and staking and all other operations of care necessary for the promotion of root growth and plant life so that all plants are in a satisfactory condition at the end of the guarantee period. The Contractor shall instruct and inform the Owner as to the watering requirements and to monitor such operations at all times. Failure to monitor the watering operation, the Contractor shall be deemed responsible to replace any and all plant material that is lost due to the improper application of water.

### PART 2 - PLANT MATERIALS

#### 2.1 PLANT MATERIAL

- A. Plants shall be sound, healthy vigorous and free from pests and diseases. They shall be well branched, be in full leaf and have a healthy root system. All plants shall be nursery grown and conform to specie and size specified.

#### 2.2 PLANT AVAILABILITY

- A. The source or supplier for all plant materials shall be furnished to the Landscape Architect prior to the delivery of any plant materials.
- B. All plant materials are to be inspected by the Landscape Architect at the time of delivery on site. This inspection does not constitute final acceptance of any plant material. All plant material will be inspected again at time of final inspection and once again at the end of the warranty period.

Any plant found to be unacceptable at any of these inspections shall be immediately removed and replaced.

- C. Unauthorized substitutions will not be accepted. If proof is submitted that specific plants or plant sizes are unobtainable, proposals will be considered for the nearest equivalent size. All proposals must be made in writing.

## 2.3 TREE WRAP

- A. Not required.

## PART 3 - PLANTING OPERATIONS

### 3.1 PLANTING OPERATIONS

- A. The exact locations of all trees and shrubs must be approved by the Landscape Architect prior to the digging of any holes. Refer to the drawings for the sizes and preparation of tree and shrub holes. Prepare all holes according to the details on the drawings.
- B. To avoid a soil water interface problem, excavated soil material from planting holes should be inspected by Landscape Architect to determine if such soil should be used as backfill material. If it is determined that the excavated material is not of good quality, then it should be modified to an acceptable texture, organic content and PH. Prior to the installing of any plant material in the prepared hole, Landscape Architect must approve the size, width and depth of the hole.
- C. Before any planting operation begins, all plants must be inspected and approved by the landscape architect. All rejected plants will be removed from the site and replaced with approved plants. This inspection does not waive any guarantee to be furnished by the Contractor.
- D. All plants will be inspected at the time of final inspection for conformance to planting procedures as specified and for general appearance and vitality. Any plant not meeting with the approval of the landscape architect will be rejected and replaced immediately.

### 3.2 MULCHING

- A. Upon completion of all planting operations, remove all undesirable material from the surface of the planting beds, including all rocks over the size of ½ inch diameter; re-establish all watering basins and install the specified mulch.

### 3.3 CLEAN-UP

- A. The contractor shall keep the site free from accumulation of waste material. At the time of completion, all areas must be swept or washed clean and all rubbish removed to the satisfaction of the Landscape Architect.

## PART 4 - SOIL PREPARATION AND SOIL MIXES

### 4.1 TOPSOIL

- A. Topsoil shall consist of natural sandy loam, which is of uniform quality and free from hard clods, stiff clay, debris or any other undesirable material. Soil shall contain at least 4 per cent organic matter. Ph range shall be 5.5 to 7.7 inclusive.
  - 1. Prior to the installation of any topsoil, contractor shall inspect the existing subgrade for compliance to the plans and specifications. Any discrepancy shall be brought to the attention of the Landscape Architect for appropriate action.

2. Spread the topsoil to the depths specified on the drawings for all planting beds. Provide a minimum of 12" of topsoil in all planting beds and a minimum of 4" of topsoil in all lawn areas. Refer to paragraph 02484-2a for the use of Prepared Backfill Material to be used immediately around all plants and the filling of all planting holes.

#### 4.2 ANIMAL FERTILIZER

- A. Not used.

#### 4.3 CHEMICAL FERTILIZER

- A. Chemical fertilizer shall be 16-16-8 with guaranteed analysis marked on the container.

#### 4.4 PEAT

- A. Reed peat, sedge peat, moss peat (fine shreds only), reed muck or sedge muck must all comply with Q-P-166e, class B coarseness.

#### 4.5 MULCH

- A. This material shall be Boise Cascade Soil Aid or equal and shall be considered to be medium coarseness. All planting beds shall receive a 2" mulch layer.

### PART 5 - SOD

#### 5.1 SCOPE

- A. The work covered by this section of the specifications consists in furnishing all sod, labor, materials and equipment and in performing all operations in connection with the installation of sod in strict accordance with this section of the specifications and the applicable drawings.
- B. Landscaping work shall be suspended at any time when it may be subject to damage by climatic conditions. However, no substantial work suspension may be made without permission of the Landscape Architect.
- C. Visit the site and be familiar with all existing conditions and extent of work performed by other contracts on the site.

#### 5.2 SOD

- A. All sod shall be two year old Kentucky Blue Grass that has been cut fresh the morning of installation. Only sod that has been grown in a commercial sod farm shall be used. Do not use sod from any other source. All sod that has not been laid within 24 hours shall be deemed unacceptable and will be removed from the site.

#### 5.3 FERTILIZER

- A. Commercial fertilizer shall be a mixed commercial fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers.

#### 5.4 TOPSOIL

- A. Topsoil shall consist of natural sandy loam and be of uniform quality, free from subsoil, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris or any other undesirable material. Soil shall be free of plants, roots, or seeds that would be toxic or harmful to growth. Topsoil shall be obtained from naturally drained areas and shall contain at least 4 percent organic material as determined by loss upon ignition of a moisture free sample that has been dried in accordance

with current methods of the Association of Official Agricultural Chemists. Ph range shall be 5.5 to 7.7 inclusive.

- B. Contractor shall furnish a certified report of an approved analytical chemist showing the analysis of the topsoil proposed for use. Furnish sample of topsoil to Landscape Architect prior to delivery of topsoil on site.
- C. Protection of the newly laid sod shall be the complete responsibility of the contractor. Provide acceptable visual barriers by means of barricades set at appropriate distances and strings or tapes between the barriers as an indication of new work. Restore any damaged areas caused by others, erosion or vehicular traffic until such a time as the lawn is accepted by the owner.

#### 5.5 INSTALLATION OF TOP SOIL

- A. When contract operations have been completed to a point where the areas will not be disturbed, subgrade shall be cleaned free of waste material of all kinds. Scarify and pulverize the subgrade to a depth of not less than 4 inches. Scarification shall be completed in all areas that are to receive plant materials whether it is to be sod, trees, ground cover or shrubs.
- B. Distribute topsoil to a depth of 4 inches over all planting areas under the contract. Do not place topsoil over subgrade that is frozen or damp.
- C. The surface on which the sod is to be laid shall be firm and free from footprints, depressions or undulations of any kind. The surface shall be free of all materials larger than ½" in diameter.
- D. The finish grade of the topsoil adjacent to all sidewalks, mowstrips, etc., and prior to the laying of the sod, shall be 1-1/2" below the top surface of the concrete or hard surface. NO EXCEPTIONS.

#### 5.6 INSTALLATION OF SOD

- A. Prior to laying of sod, the entire surface to receive sod shall be uniformly covered with the specified fertilizer at the rate of 4 pounds per 1000 square feet.
- B. Upon completion of the laying operation, an inspection of the area shall be made. All voids and large cracks between individual pieces of sod shall be filled with topsoil, prior to watering.
- C. Watering of the sod shall be the complete responsibility of the contractor by whatever means necessary to establish the sod in an acceptable manner prior to acceptance by the owner. If an irrigation system is in place on the site, but for whatever reason, water is not available in the system, it is the full responsibility of the contractor to water the sod by whatever means, until the sod is accepted by the Landscape Architect.
- D. Upon completion of filling all voids in the newly laid sod areas, the sod is to be completely saturated with water.
- E. Protection of the newly laid sod shall be the complete responsibility of the contractor. Provide acceptable visual barriers by means of barricades set at appropriate distances and strings or tapes between the barriers as an indication of new work. Restore any damaged areas caused by others, erosion or vehicular traffic until such a time as the lawn is accepted by the owner.

#### 5.7 SOD GUARANTEE

- A. The contractor shall be responsible for the protection, watering and replacement of any damaged sod until acceptance by the owner. This guarantee shall include filling any voids between sod pieces, repairing of any eroded places and maintaining the sod by watering, mowing and controlling of insects as well as advising the owner of any maintenance or watering procedures

necessary to care for and promote plant life. All sod must be in satisfactory condition at the time of the substantial completion inspection.

END OF SECTION 02480



## SECTION 02810 - IRRIGATION RESTORATION WORK

### PART 1 -

#### 1.1 GENERAL

- A. Conditions of the Contract and General Conditions, as indexed, apply to this Section.

#### 1.2 DESCRIPTION: Work includes but is not limited to the following:

- A. Provide all items, articles, materials, operations, or methods listed, mentioned or scheduled on the Drawings and/or herein specified, including all labor, equipment, and incidentals required to construct a complete and operational underground irrigation system.
- B. All excavation, backfill, and compaction, and related earthwork.
- C. All piping, watering devices, sprinkler heads, fittings, etc.
- D. System to be automatically operated with control panel and electrically operated control valves.
- E. Fees for connection to utilities such as water and power shall be paid for by the Contractor.
- F. Provide all labor, materials, services, and equipment required to revise the existing irrigation system as indicated on the drawings. When cutting of existing irrigation is required during construction, all cut or damaged lines shall be replaced such that full operation of the irrigation system is maintained.
- G. It is the intention of these specifications, together with the accompanying drawings to accomplish the work of installing an irrigation system which will operate in an efficient and satisfactory manner according to the industry irrigation standards.
- H. Test the entire system (new and existing) underground irrigation system to assure proper operation.

#### 1.3 RELATED WORK DESCRIBED ELSEWHERE

- A. Finish grading
- B. Landscaping: Lawns and Grass
- C. Landscaping: Trees, Shrubs, and Groundcover

#### 1.4 REPAIR EXISTING LAWN AREAS

- A. Repair all damage to existing lawn areas that occurs during irrigation system installation. Where damages are extensive, remove remaining sod, completely regrade affected area (adding approved quality topsoil as required) and lay new sod to satisfaction of the owner.

#### 1.5 LAYOUT OF WORK

- A. Contractor shall have complete responsibility for the layout of his work - all piping, valves, controllers, sprinklers, and other related work. The Contractor shall accurately locate and stake the locations and points necessary for the installation of the irrigation system. These will include all lines, gate valves, sprinklers, drains and quick-coupler valves.
- B. Landscape Architect will assist the Contractor in the adjustment and location of pressure lines, lateral lines, valves, and sprinkler heads where necessary.

## 1.6 PLANS AND SPECIFICATIONS

- A. All work to be performed and all materials to be furnished shall be in strict accordance with the plans and specifications. Contractor shall review the plans and specifications and bring to the attention of the Engineer and the Landscape Architect any errors, omissions or discrepancies for his consideration. Any functional operation of this system not specifically described in the Plans and Specifications shall be included in the work by the Contractor at the contract price with no additional cost to the Owner.

## 1.7 DRAWINGS

- A. General arrangement and location of irrigation equipment are indicated on the drawings. Install irrigation modifications in accordance therewith except for the minor changes required by unforeseen conflicts with work of other trades.
- B. Pipe sizes indicated on Drawings are minimum allowable.

## 1.8 AS-BUILT DRAWINGS

- A. Maintain as-built drawings at all times, indicating exact locations of all irrigation equipment and control wires installed. After completion of system installation, the Contractor shall furnish "As-built" Drawings, indicating exact location of all irrigation equipment and control wires drawn to scale with dimensions as required.

## 1.9 CONSTRUCTION CONTROL

- A. The Contractor shall install the irrigation system complete according to the plans and specifications. Any deviation from the plans, such as relocation of pipes, sprinkler heads, etc., which may better suit field conditions shall be submitted by the Contractor to the Landscape Architect for his approval. Stated maximum and minimum may not be exceeded.

## 1.10 JOB CONDITIONS

- A. Contractor must verify the elevations, grades, water source and observe all other conditions under which work is to be performed. Notify the Landscape Architect of unsatisfactory conditions and do not begin with work until unsatisfactory conditions have been corrected in a manner acceptable to the Landscape Architect.
- B. Proceed with and complete the irrigation work as rapidly as portions of the site become available, work within the seasonal limitation for each kind of work required.

## 1.11 WORK BY OTHERS

- A. The Contractor shall be charged with responsibility of arranging for the coordination of his construction operations with those of other trades on the job, and he shall permit other sources so engaged to accomplish their portion of the work with any interference or delay.

## 1.12 REFERENCE STANDARDS

- A. All pipe to conform to all requirements set forth in the Commercial Standard ASTM D 1785-76 issued by the U.S. Department of Commerce and shall be approved by the National Sanitation Foundation (NSF).

## 1.13 PACKAGED MATERIALS

- A. Deliver packaged materials in containers showing the product identification, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored on the site.

#### 1.14 OWNER'S RESPONSIBILITY FOR MAINTENANCE

- A. It will be the Owner's responsibility to maintain the system in working order during the guarantee period, performing necessary minor maintenance such as cleaning clogged nozzles, keeping grass from obstructing sprinkler heads, and preventing vandalism and damage during the normal maintenance operation.

#### 1.15 MAINTENANCE INSTRUCTION MANUALS

- A. Submit three (3) copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of the system from year to year (i.e. Drain procedures, winterizing features, etc.). Submit manuals with As-Built Drawings. The manual shall also contain:
  - 1. Identification readable from the outside of the cover stating by whom the information was compiled.
  - 2. Neatly typewritten index near the front of the manual, furnishing immediate information as to the location in the manual of all emergency data regarding the installation.
  - 3. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts.
  - 4. Complete outline of future watering schedules and why they should be changed from the present initial installation schedule shown. The present schedule is calculated for 2-1/2" per week watering rate to establish new lawn.
  - 5. Copy of all guarantees and warranties issued on the installation, showing all dates of expiration.

#### 1.16 IRRIGATION RESTORATION

- A. Where existing or new irrigation systems or components have been damaged during construction, the Contractor shall repair irrigation system, using new material, to meet the standards of quality described within this section. Before the commencement of his work, the Contractor shall identify and provide the Landscape Architect with written notice and photographs, if deemed necessary, of any existing damage to the irrigation systems.

#### 1.17 MAINTAIN ADJACENT IRRIGATION SYSTEMS

- A. Where construction of this project will affect other existing irrigation systems outside of the construction area, the Contractor shall be responsible to make modifications to existing irrigation systems to maintain water coverage outside construction area. In the event that such modifications are not made, Contractor shall be responsible to restore landscape damage which resulted from lack of water.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Pipes and Fittings
  - 1. Lateral lines shall be Schedule 40, pressure rated, PVC with the ratings printed on the pipe. Pipe shall be free from cracks, holes, foreign material, blisters, inside bubbles, wrinkles and dents. No pipe shall be less than 1" (one inch) diameter. All joints shall be solvent welded, or made with threaded fittings.
  - 2. Main lines shall be Schedule 40, pressure rated PVC with ratings printed on the pipe. Pipe shall be free from cracks, holes, foreign material, blisters, inside bubbles, wrinkles and dents. Sizes shall be as shown on the drawings. All joints shall be solvent welded.
  - 3. All pipe joints shall be solvent welded together using IPS 70 Primer and IPS 711 cement.

4. Connections on main lines must be allowed to set for "24" hours prior to pressurization.
5. Flex swing risers shall be THICK-WALLED POLY PIPE as manufactured by TORO or RAINBIRD. This pipe is to be used only between heads and lateral lines and shall not exceed a distance of 5 ft. for use on heads of 7 GPM or less. All heads exceeding 7 GPM shall be installed with a prefabricated swing joint of appropriate size.
6. Fittings on lateral lines and main lines shall be Schedule 40 pressure rated PVC. Do NOT use galvanized fittings of any kind on any PVC lines or fittings.
7. Fittings on flex swing risers shall be schedule 80 barbed insert ells or threaded as manufactured by TORO or RAINBIRD.

#### B. Ball Valves

1. Ball Valves shall be solid bronze meeting Federal Specification WW-V-54, CLASS A, TYPE 1. Size shall be the same size as the main line on which it is installed. Valve shall be installed on the up-stream side of the electric remote control valve and in the same valve box.

#### C. Stop and Waste Valves

1. Stop and waste ball type valves shall be solid bronze meeting Federal Specification WW-V-54, CLASS A, TYPE 1. Size shall be the same as the line on which it is installed. This valve must be installed below the frost line and in an adjustable curb box as herein specified. Valve shall be handle operated, and of Mueller and/or Ford Type (ball valve).

#### D. Backflow Prevention

1. Reduced Pressure Backflow Preventer shall be an approved assembly with accessory construction, modular design and replaceable seats. This valve shall meet the following standards: ASSE No.1013; AWWA C506-78; and USC Foundation for Cross Connection Control and Hydraulic Research. This valve must be serviceable "in line" and have ball valve test cocks and valves on both sides for testing. Installation shall be on the mainline in an accessible location. Exact location to be approved on site by the Landscape Architect and Draper Prison Site Utilities. The Reduced Pressure Backflow Preventer assembly shall not be installed underground. Installation and function must be checked and certified by a certified individual prior to final acceptance.

#### E. Electric Remote Control Valve

1. All electric remote control valves shall be of the size and type as specified on the drawings. Do not mix lawn and shrub zones if possible. Approved electric remote control valves are:
 

|                               |         |
|-------------------------------|---------|
| (a) 1" TORO 254-06-04         | plastic |
| (b) 1-1/2" TORO 252-26-0-6    | plastic |
| (c) 2" TORO 252-26-0-8        | plastic |
| (d) 1-1/2" TORO 216-26-06     | brass   |
| (e) 2" TORO 216-26-08         | brass   |
| (f) 1-1/2" RAINBIRD 150 EFBCP | brass   |
| (g) 2" RAINBIRD 200 FFBCP     | brass   |

#### F. Drain Valves

1. All drain valves shall be 3/4" Mueller &/or Ford ball type and installed as per details on the drawings. Drain valves are to be installed on **mainlines** only.

#### G. Electric Control Wire

1. Wires shall be UF DIRECT BURIAL type and as sized on the drawings. No wire shall be smaller than #14. Ground or neutral wires shall be WHITE, grass areas shall be RED and shrubby areas shall be BLUE. **NO EXCEPTIONS.** All wires shall be direct runs with no

- splices. Wires cannot be spliced without approval of Landscape Architect or Project Manager.
2. Splices in electric control wires shall be soldered first and then fitted with a 3M DBY Direct Bury Splice Kit. **NO EXCEPTIONS.** All splices shall be contained in a valve box.
  3. All wire shall be of 600V direct bury type.

#### H. Automatic Clock

1. All clocks shall be Osmac RDR as specified on the drawings and installed according to the details. Ground all clocks with an 8 foot grounding rod, using a #6 or larger solid copper wire. Exact location of clock shall be determined on site by the Landscape Architect, Grounds Department, and Draper Prison Site Utilities Project Manager. Controller shall be provided with signal access to a central controller.

#### I. Sleeves

1. All sleeves shall be PVC, 4" diameter: Install sleeves in locations as shown on the drawings and at the depths specified for lateral and mainlines. Coordinate the installation of the sleeves with installation of all hard surfaces. Mark location of all sleeves with a 3/4" galvanized roofing nail at both sides of sidewalk or curb and gutter or asphalt in such a manner that future location will not require more than hand shovel excavation. Insure that adequate amounts of sleeving are installed for both water lines and electric control wires.

### 2.2 BACKFILL MATERIAL

- A. Backfill material shall consist of earth, sand, silts, and clay or any combination thereof with no rocks larger than one (1) inch. Line bedding material shall be sand with two (2) inches of cover around pipe minimum. Landscape Architect shall approve on site material for backfill operation.
- B. Imported backfill material, as required, shall be clean soil, free from organic material, trash, debris, rubbish, broken cement, asphalt material or other objectionable substances and approved by the Landscape Architect.

### 2.3 DRAINAGE FILL MATERIAL

- A. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.

### 2.4 EXISTING UTILITIES

- A. The location of existing utilities and structures are shown on the drawings. Before any trenching, excavation or digging has begun, the contractor shall obtain a "Digging Permit" and have the area "Blue Staked" in order to determine as close as possible the location of all underground utilities. The contractor will conduct his work in such a manner to protect all existing utilities from damage. It is the responsibility of the contractor to repair or replace any damage incurred by them or their work people at no expense to the owner.

## PART 3 - EXECUTION

### 3.1 PREPARATION

#### A. Trenches

1. Trenches for lateral lines shall be dug a minimum of 12" deep and as wide as necessary to properly install pipes.
2. Trenches for mainlines shall be dug a minimum of 18" deep and as wide as necessary to properly install pipes. Run all electrical wires in mainline trench as shown on detail drawings.

3. Trenches where more than one pipe is to be installed a distance of 6" is to be maintained between each pipe. **NO EXCEPTIONS.**
4. All trenches are to be 12" away from all curbs, buildings and sidewalks. **NO EXCEPTIONS.**
5. Grade and lay all piping such that the entire system will drain. Where possible, drain the main line to the valve manifold and install the drain in the valve box. All lateral lines beyond the valve manifold should be laid in such a manner as to drain to a single low point. The lateral lines will be "blown out" by the use of compressed air. **Do NOT install automatic drains.**
6. Lateral lines must be level.

#### B. Drains

1. All drains shall be 3/4" Oriseal Type curb valve.
2. Drains shall be installed at all low points on the mainline only. Each drain shall be provided with a gravel sump of 18" x 18" x 18" filled with 1" diameter gravel. Install the mainline such that a minimum number of drains are required. Refer to the detailed drawings for valve stem extensions and valve markers.

#### C. Valve Boxes

1. Valve boxes shall be set flush with the finished grade. Valve manifolds shall be set 4" below the top of the box including ball valves and quick couplers where called for. Do NOT install more than two (2) electric remote control valves in a single standard valve box, and no more than four (4) valves in a jumbo box. All valves must have ample room for access and repair.
2. A 3/4" hose bibb shall be installed in each valve box at each manifold location. The hose bibb shall be of "bent nose" or angle type.
3. Install as close to building entrance as possible.

#### D. Quick Couplers

1. Quick Couplers shall be installed on a swing joint as detailed on the drawings. Install the quick coupler on the downstream side of the ball valve and extend the swing joint such that access will be inside the valve box. At locations where "no" valve box is close at hand, provide a 6" round I.C.U. valve box by Brooks over the valve and coupler.

#### E. Backfilling of Trenches

1. Backfill around and over the pipes in accordance with the details on the drawings. All material that is to come in contact with the pipes shall be less than 1/4 inch in diameter. This material shall be imported for this specific use. Only upon the approval of the Landscape Architect, can the existing material on site be used as backfill material above the pipes. Compaction shall be as detailed on the drawings (95% under walks and roadways, 90% at lawn areas.).

#### F. Piping Inspections

1. Before any pipes are covered, the Landscape Architect or a representative of the owner shall inspect the system for compliance with specifications and drawings. Any required changes will be made at this time at no expense to the owner.

#### G. Flushing and Testing

1. After installation of all new pipes and risers for a given circuit and before the installation of any irrigation head, the control valve shall be opened fully and a full head of water be used to flush out the system. Each auto valve will then be disassembled, and inspected for rocks, cleaned and reassembled.
2. Testing will be performed after completion of each circuit and after completion of the entire system. At this time any necessary repair work will be done at the contractor's expense and

the entire system will be in good working order prior to the issuance of the Substantial Completion.

#### H. System Operation

1. The entire system will be tested in the presence of the Landscape Architect, Grounds Department, and Draper Prison Site Utilities Project Manager in order to insure COMPLETE coverage of all areas to be watered and the automatic operation of the system using the automatic clock. Any changes required will be made at this time at the contractor's expense.
2. All heads will be adjusted to their proper coverage and set to the proper depth at this time.
3. It will be the responsibility of the Contractor to work with the Grounds Department and Sprinkler Shop to drain and winterize the system in the fall. It will also be their responsibility to help activate system in the spring and make sure there are no problems.

#### I. Guarantee

1. All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of substantial completion. The contractor shall correct any deficiencies when notified during the warranty period and correct in satisfactory condition any damage to the buildings or grounds, without cost to the owner. All guarantees shall be in writing and approved by the Landscape Architect before submitting to the owner.
2. AS-BUILT DRAWINGS shall be furnished to the Landscape Architect at the time of the Systems Inspection before any Substantial Completion Date will be issued.

### PART 4 - MEASUREMENT

#### 4.1 MEASUREMENT

- A. A complete and operational irrigation system as determined by the Engineer and the Landscape Architect.

END OF SECTION 02810